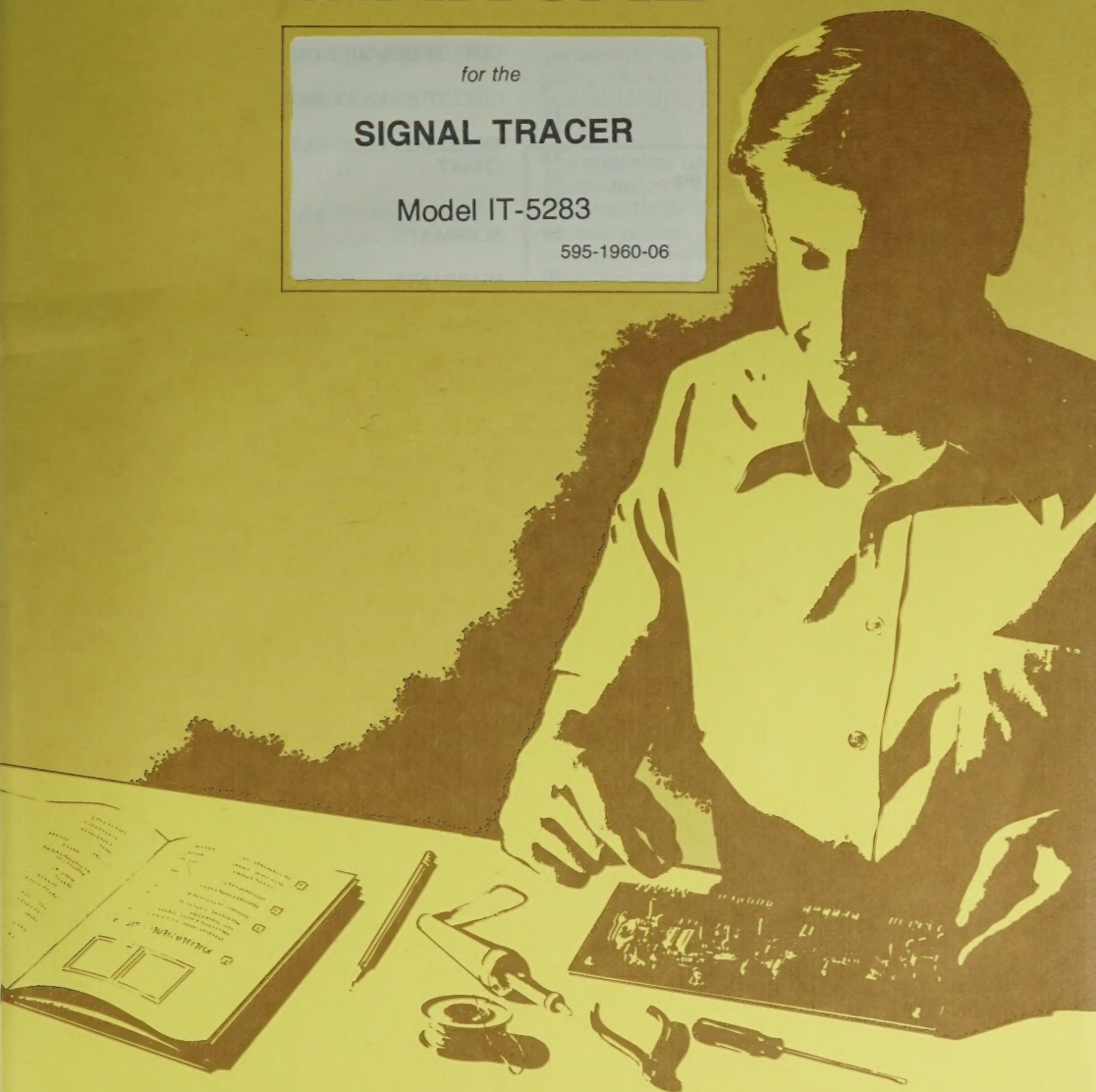


HEATHKIT[®] MANUAL

for the
SIGNAL TRACER

Model IT-5283

595-1960-06



HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information	(616) 982-3411
Credit	(616) 982-3561
Replacement Parts	(616) 982-3571

Technical Assistance Phone Numbers

8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only	
Audio	(616) 982-3310
Amateur Radio	(616) 982-3296
Test Equipment, Weather Instruments and	
Home Clocks	(616) 982-3315
Television	(616) 982-3307
Aircraft, Marine, Security, Scanners, Automotive,	
Appliances and General Products	(616) 982-3496
Computers — Hardware	(616) 982-3300
Computers — Software:	
Operating Systems, Languages, Utilities	(616) 982-3860
Application Programs	(616) 982-3884

YOUR HEATHKIT 90-DAY LIMITED WARRANTY

Consumer Protection Plan for Heathkit Consumer Products

Welcome to the Heath family. We believe you will enjoy assembling your kit and will be pleased with its performance. Please read this Consumer Protection Plan carefully. It is a "LIMITED WARRANTY" as defined in the U.S. Consumer Product Warranty and Federal Trade Commission Improvement Act. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Heath's Responsibility

PARTS — Replacements for factory defective parts will be supplied free for 90 days from date of purchase. Replacement parts are warranted for the remaining portion of the original warranty period. You can obtain warranty parts direct from Heath Company by writing or telephoning us at (616) 982-3571. And we will pay shipping charges to get those parts to you . . . anywhere in the world.

SERVICE LABOR — For a period of 90 days from the date of purchase, any malfunction caused by defective parts or error in design will be corrected at no charge to you. You must deliver the unit at your expense to the Heath factory, any Heathkit Electronic Center (units of Veritechnology Electronics Corporation), or any of our authorized overseas distributors.

TECHNICAL CONSULTATION — You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

NOT COVERED — The correction of assembly errors, adjustments, calibration, and damage due to misuse, abuse, or negligence are not covered by the warranty. Use of corrosive solder and/or the unauthorized modification of the product or of any furnished component will void this warranty in its entirety. This warranty does not include reimbursement for inconvenience, loss of use, customer assembly, set-up time, or unauthorized service.

This warranty covers only Heath products and is not extended to other equipment or components that a customer uses in conjunction with our products.

SUCH REPAIR AND REPLACEMENT SHALL BE THE SOLE REMEDY OF THE CUSTOMER AND THERE SHALL BE NO LIABILITY ON THE PART OF HEATH FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO ANY LOSS OF BUSINESS OR PROFITS, WHETHER OR NOT FORSEEABLE.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Owner's Responsibility

EFFECTIVE WARRANTY DATE — Warranty begins on the date of first consumer purchase. You must supply a copy of your proof of purchase when you request warranty service or parts.

ASSEMBLY — Before seeking warranty service, you should complete the assembly by carefully following the manual instructions. Heathkit service agencies cannot complete assembly and adjustments that are customer's responsibility.

ACCESSORY EQUIPMENT — Performance malfunctions involving other non-Heath accessory equipment, (antennas, audio components, computer peripherals and software, etc.) are not covered by this warranty and are the owner's responsibility.

SHIPPING UNITS — Follow the packing instructions published in the assembly manuals. Damage due to inadequate packing cannot be repaired under warranty.

If you are not satisfied with our service (warranty or otherwise) or our products, write directly to our Director of Customer Service, Heath Company, Benton Harbor MI 49022. He will make certain your problems receive immediate, personal attention.

Heathkit® Manual

for the

SIGNAL TRACER

Model IT-5283

595-1960-06



HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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INTRODUCTION

The Heathkit Signal Tracer is a compact, service-oriented instrument that incorporates many features that meet the everyday needs of the service technician. Some of the features and applications are as follows:

- Signal tracing in RF and IF circuits.
- Signal tracing in audio circuits.
- Convenient RF-Audio (RF-AF) switching in the probe body.
- Use in troubleshooting AM and FM receivers and television.
- Use for speaker substitution.

- Use in checking microphones, musical instruments, pickups, and speakers.

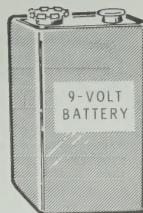
The signal Tracer is housed in a compact cabinet which is designed to match other instrument series cabinets. The cabinet has a convenient storage compartment that lifts for easy access to cables and accessories. The kit is designed to operate from batteries (not supplied) or from the optional Heathkit power supply.

The type 5280 series includes the Model IM-5284 Multimeter, the Model IPA-5280-1 Power Supply, and several other kits. If you have purchased the Multimeter, you may want to build it first so that it is available to check the other kits as you assemble them. You may want to build the power supply next to avoid the need for batteries.

BATTERIES

If you intend to use batteries, you should purchase two 9-volt transistor batteries, NEDA #1604, at this time for use in your kit. Representative manufacturers and their type numbers are:

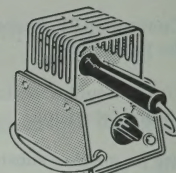
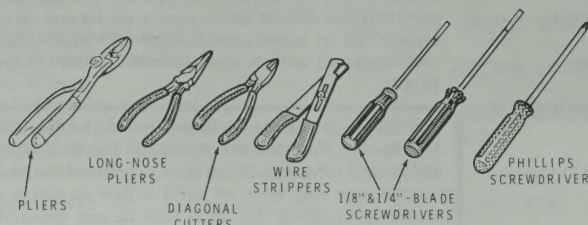
Eveready #216, PP3
 Burgess #2U6
 Mallory #TR-146X (long life)
 RCA #VS323
 Hellesens #410
 Varta #438
 CEI #6F22



ASSEMBLY NOTES

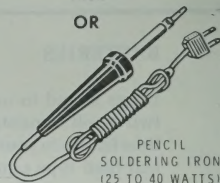
TOOLS

You will need these tools to assemble your kit.



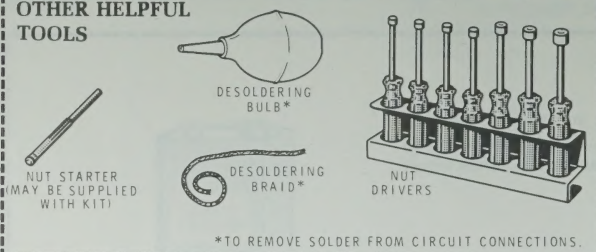
HEATHKIT
SOLDERING
IRON

OR



PENCIL
SOLDERING IRON
(25 TO 40 WATTS)

OTHER HELPFUL TOOLS



*TO REMOVE SOLDER FROM CIRCUIT CONNECTIONS.

ASSEMBLY

1. Follow the instructions carefully and read the entire step before you perform the operation.
2. The illustrations in the Manual are called Pictorials and Details. Pictorials show the overall operation for a group of assembly steps; Details generally illustrate a single step. When you are directed to refer to a certain Pictorial "for the following steps," continue using that Pictorial until you are referred to another Pictorial for another group of steps.
3. Most kits use a separate "Illustration Booklet" that contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in Pictorial number sequence.
4. Position all parts as shown in the Pictorials.
5. Solder a part or a group of parts only when you are instructed to do so.

6. When you are instructed to cut something to a particular length, use the scales (rulers) provided at the bottom of the Manual pages.

SAFETY WARNING: Avoid eye injury when you cut off excess lead lengths. Hold the leads so they cannot fly toward your eyes.

SOLDERING

Soldering is one of the most important operations you will perform while assembling your kit. A good solder connection will form an electrical connection between two parts, such as a component lead and a circuit board foil. A bad solder connection could prevent an otherwise well-assembled kit from operating properly.

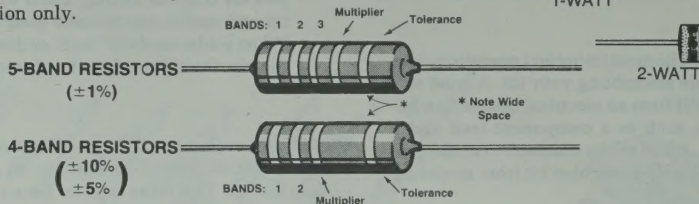
It is easy to make a good solder connection if you follow a few simple rules:

1. Use the right type of soldering iron. A 25 to 40-watt pencil soldering iron with a 1/8" or 3/16" chisel or pyramid tip works best.
2. Keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth; then apply solder to the tip to give the entire tip a wet look. This process is called tinning, and it will protect the tip and enable you to make good connections. When solder tends to "ball" or does not stick to the tip, the tip needs to be cleaned and retinned.

NOTE: Always use rosin core, radio-type solder (60:40 or 50:50 tin-lead content) for all of the soldering in this kit. This is the type we have supplied with the parts. The Warranty will be void and we will not service any kit in which acid core solder or paste has been used.

PARTS

Resistors will be called out by their resistance value in Ω (ohms), $k\Omega$ (kilohms), or $M\Omega$ (megohms). Certain types of resistors will have the value printed on the body, while others will be identified by a color code. The colors of the bands and the value will be given in the steps, therefore the following color code is given for information only.



Band 1 1st Digit		Band 2 2nd Digit		Band 3 (if used) 3rd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	0	Black	1	Silver	$\pm 10\%$
Brown	1	Brown	1	Brown	1	Brown	10	Gold	$\pm 5\%$
Red	2	Red	2	Red	2	Red	100	Brown	$\pm 1\%$
Orange	3	Orange	3	Orange	3	Orange	1,000		
Yellow	4	Yellow	4	Yellow	4	Yellow	10,000		
Green	5	Green	5	Green	5	Green	100,000		
Blue	6	Blue	6	Blue	6	Blue	1,000,000		
Violet	7	Violet	7	Violet	7	Silver	0.01		
Gray	8	Gray	8	Gray	8	Gold	0.1		
White	9	White	9	White	9				

Capacitors will be called out by their capacitance value in μF (microfarads) or pF (picofarads) and type: ceramic, Mylar*, electrolytic, etc. Some capacitors may have their value printed in the following manner:

First digit of capacitor's value: 1

Second digit of capacitor's value: 5

Multiplier: Multiply the first & second digits by the proper value from the Multiplier Chart.

To find the tolerance of the capacitor, look up this letter in the Tolerance columns.



EXAMPLES:

151K = $15 \times 10 = 150 \text{ pF}$
 759 = $75 \times 0.1 = 7.5 \text{ pF}$

NOTE: The letter "R" may be used at times to signify a decimal point: as in: 2R2 = 2.2 (pF or μF).

MULTIPLIER		TOLERANCE OF CAPACITOR		
FOR THE NUMBER:	MULTIPLY BY:	10 pF OR LESS	LETTER	OVER 10 pF
0	1	$\pm 0.1 \text{ pF}$	B	
1	10	$\pm 0.25 \text{ pF}$	C	
2	100	$\pm 0.5 \text{ pF}$	D	
3	1000	$\pm 1.0 \text{ pF}$	F	$\pm 1\%$
4	10,000	$\pm 2.0 \text{ pF}$	G	$\pm 2\%$
5	100,000		H	$\pm 3\%$
			J	$\pm 5\%$
8	0.01		K	$\pm 10\%$
9	0.1		M	$\pm 20\%$

PARTS LIST

Check each part against the following list. Any part that is packed in an individual envelope with a part number on it should be placed back in the envelope after you identify it until it is called for in a step. Do not discard any packing material until all parts are accounted for.

To order a replacement part, always include the Part Number and use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, use one of the "Expedited Parts Order Forms" at the rear of this Manual, or refer to "Replacement Parts" inside the rear cover. Your Warranty is inside the front cover. For prices, refer to the separate "Heath Parts Price List."

Each circuit part in this kit has its own "circuit component number" (R2, C4, Q1, etc.). This is a specific number for only that one part. The purpose of these numbers is to help you easily identify the same part in each section of the Manual. These numbers will appear:

- In the Parts List;
- At the beginning of each step where a component is installed;
- In some illustrations;
- On the Schematic;
- In the sections at the rear of the Manual.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
------------	-------------------	------	-------------	----------------------

RESISTORS

NOTE: The following resistors have a tolerance of 5%. 5% is indicated by a fourth color band of gold. The resistors may be packed in more than one envelope.

A1	6-399	✓	3.9 Ω (orange-white-gold)	R20
A1	6-479	✓	4.7 Ω (yellow-violet-gold)	R18
A1	6-470	2 ✓	47 Ω (yellow-violet-black)	R7, R14
A1	6-471	✓	470 Ω (yellow-violet-brown)	R21
A1	6-821	✓	820 Ω (gray-red-brown)	R19
A1	6-102	✓	1000 Ω (brown-black-red)	R9
A1	6-122	✓	1200 Ω (brown-red-red)	R5
A1	6-222	✓	2200 Ω (red-red-red)	R16
A1	6-332	✓	3300 Ω (orange-orange-red)	R6
A1	6-472	✓	4700 Ω (yellow-violet-red)	R15
A1	6-103	2	10 kΩ (brown-black-orange)	R8, R11
A1	6-153	✓	15 kΩ (brown-green-orange)	R17
A1	6-104	2	100 kΩ (brown-black-yellow)	R2, R4
A1	6-394	✓	390 kΩ (orange-white-yellow)	R13

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
------------	-------------------	------	-------------	----------------------

Resistors (cont'd.)

A1	6-474	✓ 1	470 kΩ (yellow-violet-yellow)	R12
A1	6-105	✓ 1	1 MΩ (brown-black-green)	R3
A1	6-335	✓ 1	3.3 MΩ (orange-orange-green)	R1

CAPACITORS

NOTE: Tubular capacitors may be marked with color bands or a number.

B1	21-175	✓	1000 pF (brown-black-red-yellow or 102K) ceramic	C1
B2	25-879	2	4.7 μF electrolytic	C3, C5
B2	25-883	2	47 μF electrolytic	C6, C7
B2	25-887	3	220 μF electrolytic	C8, C9, C11
B3	27-47	2	.1 μF 100-volt Mylar	C4, C10
B4	27-28	✓ 1	.1 μF 400-volt Mylar	C2

CONTROL — SWITCH

C1	10-299	✓ 1	100 kΩ control	R10
C2	63-1295	✓	Rotary switch	SW1

KEY	HEATH	QTY.	DESCRIPTION	CIRCUIT
No.	Part No.			Comp. No.

DIODES — TRANSISTORS

NOTE: Transistors are marked for identification in one of the following four ways:

1. Part number.
2. Type number.
3. Part number and type number.
4. Part number with a type number other than the one listed.

D1	56-56	5	1N4149 diode	D1 (probe) D2, D3, D4, D5
D1	57-65	2	1N4002 diode	D6, D7
D2	417-222	1	2N5308 transistor	Q1
D2	417-235	4	2N4121 transistor	Q2, Q4, Q6, Q8
D2	417-285	1	2N4893 transistor	Q3
D2	417-801	2	MPSA20 transistor	Q5, Q7

CONNECTOR — JACKS — PLUG — INSULATORS

E1	432-798	2	Battery connector
E2	436-11	2	Red banana jack
E2	436-22	2	Black banana jack
E3	438-47	2	Banana plug
E4	70-10	1	Black plastic insulator
E4	70-11	1	Red plastic insulator

HARDWARE

F1	250-56	4	6-32 × 1/4" screw
F2	250-162	5	8-32 × 1/2" screw
F3	250-592	2	#6 × 3/8" self-tapping screw
F4	250-1150	4	6-32 × 1/2" phillips-head screw
F5	252-3	8	6-32 nut
F6	254-1	8	#6 lockwasher
F7	252-7	1	Control nut
F8	252-195	5	Self-retaining nut
F9	253-10	1	Control flat washer
F10	254-5	1	Control lockwasher

KEY	HEATH	QTY.	DESCRIPTION	CIRCUIT
No.	Part No.			Comp. No.

PROBE PARTS

G1	253-51	1	E washer
G2	256-15	2	1/16" × 1/8" rivet
G3	258-53	1	Probe contact loading spring
G4	459-55	1	Probe, consisting of:
	459-43	1	Rear section of probe body
	459-45	1	Center section of probe body
	459-46	1	Probe switch lever
	459-54	1	Front section of probe body
G5	459-47	1	Probe insert insulator
G6	477-11	1	Probe spike

WIRE

341-1	3'	Black test lead
343-11	3'6"	Shielded test cable (large diameter)
343-15	2'	Shielded cable (small diameter)
344-50	1'6"	Black wire
344-52	2'	Red wire
344-551	1'6"	Green wire
344-59	2'	White wire

MISCELLANEOUS

H1	73-64	2	Double-stick foam tape
	85-1921-2	1	Circuit board
H2	92-662	1	Cabinet consisting of:
	92-659	1	Cabinet top
	92-660	1	Cabinet bottom
	92-661	1	Cabinet cover (assembled to top)
	92-668	1	Cover plate
H3	200-1290	1	Chassis
H4	203-1870-1	1	Front panel
H5	209-37	1	Speaker grille
H6	260-1	1	Alligator clip
H7	391-34	1	Blue and white label
H8	401-165	1	Speaker
H9	455-50	1	Knob bushing
H10	462-314	1	Knob
	597-260	1	Parts Order Form
		1	Assembly Manual (see Page 1 for Part Number)

Solder

STEP-BY-STEP ASSEMBLY

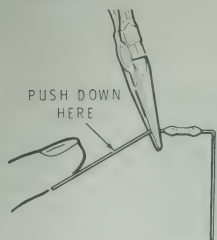
CIRCUIT BOARD ASSEMBLY

START

In the following steps, you will be given detailed instructions on how to install and solder the first part on the circuit board. Read and perform each step carefully. Then use the same procedure whenever you install parts on a circuit board.

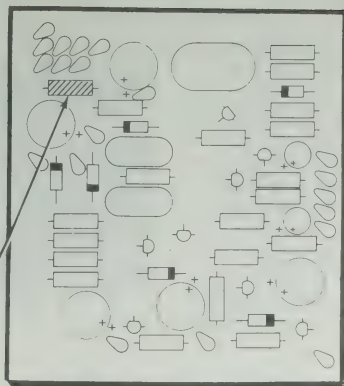
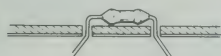
- () Position the circuit board as shown with the printed side (not the foil side) up.

- () R21: Hold a 470 Ω (yellow-violet-brown) resistor by the body as shown and bend the leads straight down.



- () Push the leads through the holes at the indicated location on the circuit board. The end with color bands may be positioned either way.

- () Press the resistor against the circuit board. Then bend the leads outward slightly to hold the resistor in place.

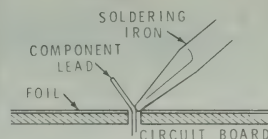


PICTORIAL 1-1

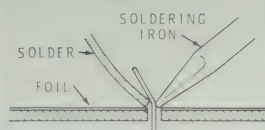
CONTINUE

- () Solder the resistor leads to the circuit board as follows:

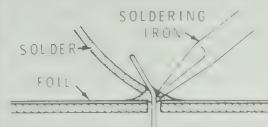
1. Push the soldering iron tip against both the lead and the circuit board foil. Heat both for two or three seconds.



2. Then apply solder to the other side of the connection. IMPORTANT: Let the heated lead and the circuit board foil melt the solder.



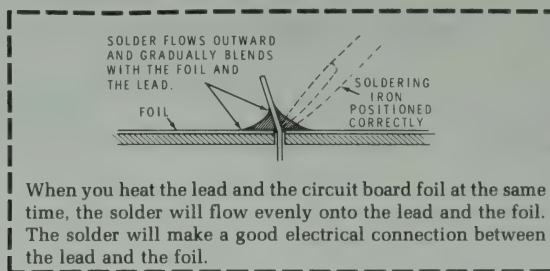
3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.



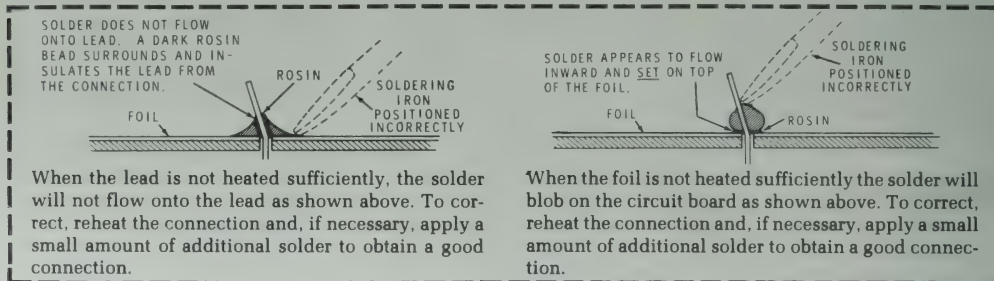
- () Cut off the excess lead lengths close to the connection. WARNING: Clip the leads so the ends will not fly toward your eyes.

- () Check each connection. Compare it to the illustrations on Page 10. After you have checked the solder connections, proceed with the assembly on Page 11. Use the same soldering procedure for each connection.

A GOOD SOLDER CONNECTION



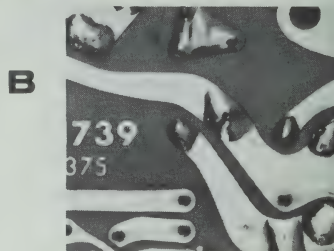
POOR SOLDER CONNECTIONS



SOLDER BRIDGES

A solder bridge between two adjacent foils is shown in photograph A. Photograph B shows how the connection should appear. A solder bridge may occur if you accidentally touch an adjacent previously soldered connection, if you use too much solder, or if you "drag" the soldering iron across other foils as you remove it from the connection. A good rule to follow is; always take a good look at the foil area around each lead before you solder it. Then, when you solder the connection, make sure the solder remains in this area and does not bridge to another foil. This is especially important when the foils are small and close together. NOTE: It is alright for solder to bridge two connections on the same foil.

Use only enough solder to make a good connection, and lift the soldering iron straight up from the circuit board. If a solder bridge should develop, turn the circuit board foil-side-down and heat the solder between connections. The excess solder will run onto the tip of the soldering iron, and this will remove the solder bridge. NOTE: The foil side of the circuit board has a coating on it called "solder resist." This is a protective insulation to help prevent solder bridges.

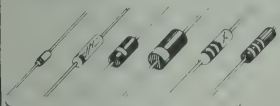


START

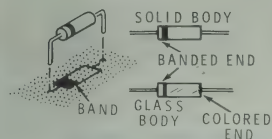
- () R1: 3.3 M Ω (orange-orange-green).

NOTE: When you install a diode, always match the band on the diode with the band mark on the circuit board. THE CIRCUIT WILL NOT WORK PROPERLY IF A DIODE IS INSTALLED BACKWARDS.

IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.



BANDED END



If your diode has a solid body, the band is clearly defined. If your diode has a glass body, do not mistake the colored end inside the diode for the banded end. Look for a band painted on the outside of the glass.

- () D2: 1N4149 diode (#56-56).
- () D5: 1N4149 diode (#56-56).
- () D4: 1N4149 diode (#56-56).
- () R7: 47 Ω (yellow-violet-black).
- () R12: 470 k Ω (yellow-violet-yellow).
- () R18: 4.7 Ω (yellow-violet-gold).
- () R16: 2200 Ω (red-red-red).
- () R17: 15 k Ω (brown-green-orange).
- () R19: 820 Ω (gray-red-brown).

- () Solder the leads to the foil and cut off the excess lead lengths.

CONTINUE

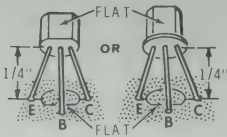
- () R3: 1 M Ω (brown-black-green).
- () R2: 100 k Ω (brown-black-yellow).
- () D3: 1N4149 diode (#56-56).
- () R9: 1000 Ω (brown-black-red).
- () R8: 10 k Ω (brown-black-orange).
- () R5: 1200 Ω (brown-red-red).
- () R4: 100 k Ω (brown-black-yellow).
- () Solder the leads to the foil and cut off the excess lead lengths.
- () R6: 3300 Ω (orange-orange-red).
- () R11: 10 k Ω (brown-black-orange).
- () R13: 390 k Ω (orange-white-yellow).
- () R14: 47 Ω (yellow-violet-black).
- () R15: 4700 Ω (yellow-violet-red).
- () D7: 1N4002 diode (#57-65).
- () R20: 3.9 Ω (orange-white-gold).
- () D6: 1N4002 diode (#57-65).

- () Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 1-2

START

1. Refer to the illustration below and identify the E, C, and B leads of the transistor.
2. Insert the transistor leads into the corresponding E, B, and C holes in the circuit board.
3. Position the transistor 1/4" above the circuit board.
4. Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.



[] Q2: 2N4121 transistor (#417-235).

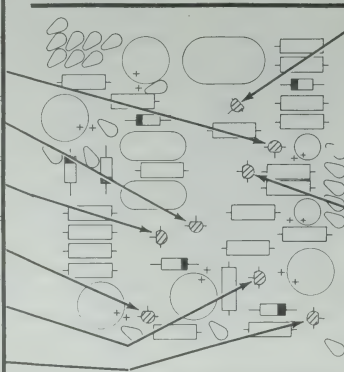
[] Q4: 2N4121 transistor (#417-235.)

[] Q6: 2N4121 transistor (#417-235).

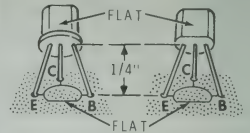
[] Q7: MPSA20 transistor (#417-801).

[] Q5: MPSA20 transistor (#417-801).

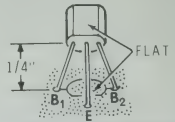
[] Q8: 2N4121 transistor (#417-235).

**CONTINUE**

- [/] Q1: Install the 2N5308 transistor (#417-222) as follows:



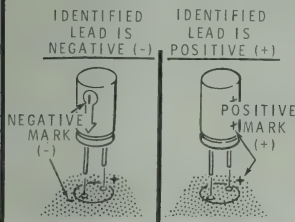
- [] Q3: 2N4893 transistor (#417-285).



PICTORIAL 1-3

START

NOTE: Before you install an electrolytic capacitor, look at it and identify the leads. One lead will have a plus (+) mark or a minus (-) mark near it. **Be sure** to install the positive lead in the positive-marked hole. Be careful only the negative lead may be marked.



☒ C9: 220 μ F electrolytic.

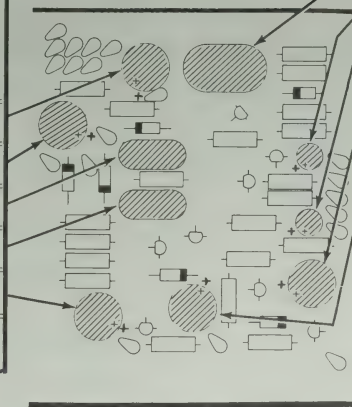
☒ C8: 220 μ F electrolytic.

☒ C4: .1 μ F 100V Mylar.

☒ C10: .1 μ F 100V Mylar.

☒ C11: 220 μ F electrolytic.

☐ Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 1-4

CONTINUE

☒ C2: .1 μ F 400V Mylar.

☐ C3: 4.7 μ F electrolytic.

☐ C5: 4.7 μ F electrolytic.

☐ C6: 47 μ F electrolytic.

☐ C7: 47 μ F electrolytic.

☐ Solder the leads to the foil and cut off the excess lead lengths.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

☐ Unsoldered connections.

☐ Poor solder connections.

☐ Solder bridges between foils.

☐ Protruding leads which could touch together.

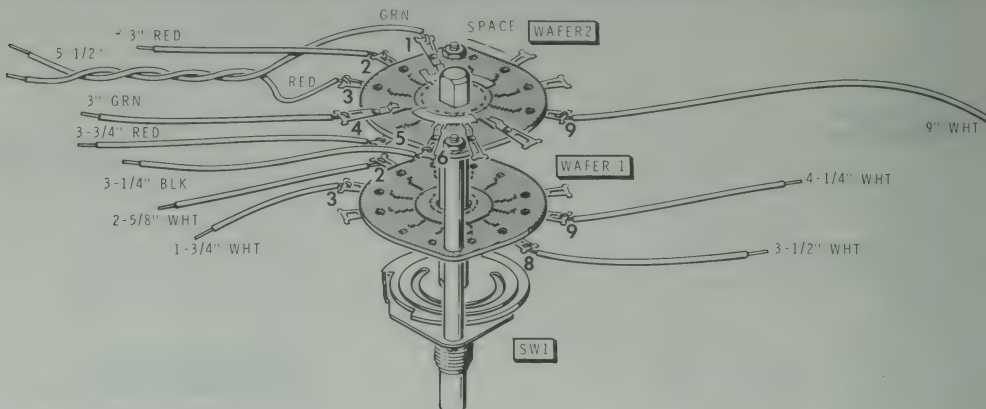
☐ Transistors for the proper type and installation.

☐ Electrolytic capacitors for the correct position of the positive (+) end.

☐ Diodes for the correct position of the banded end.

Set the circuit board aside.

FINISH



PICTORIAL 2-1

SWITCH WIRING

Refer to Pictorial 2-1 for the following steps.

NOTE: As you wire this kit, you will be instructed to prepare wires ahead of time as in the following step. To prepare a wire, cut it to the indicated length and then remove 1/4" of insulation from each end. The wires are listed in the order they will be used.

- () Prepare the following wires:

2-5/8" white
1-3/4" white
3" red
3" green
3-3/4" red

- () Position rotary switch SW1 with the lugs oriented as shown.

NOTES:

- Pictorial 2-1 shows how each lug on the rotary switch is numbered. Each lug location has a number, even when a lug is not mounted at that location on the wafer. Note that lug 12 (indicated by the space) is missing at wafer 2.
- In the following steps, "S-" with a number, means to solder the connection. The number following the "S" tells how many wires are at the connection. (NS) means not to solder because other wires will be added later.

Connect the prepared wires to SW1 as follows:

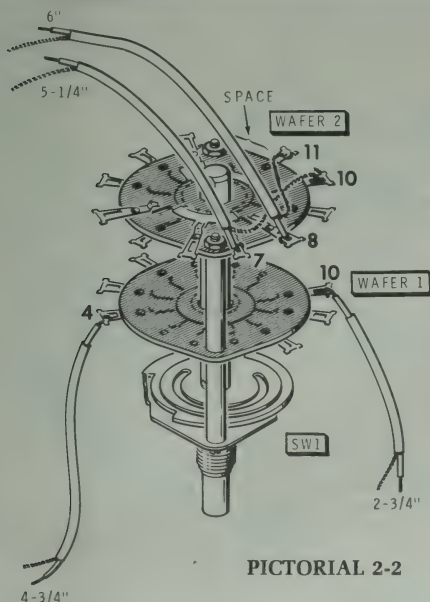
- () 2-5/8" white wire to wafer 1 lug 2 (S-1).
() 1-3/4" white wire to wafer 1 lug 3 (S-1).
() 3" red wire to wafer 2 lug 2 (S-1).
() 3" green wire to wafer 2 lug 4 (S-1).
() 3-3/4" red wire to wafer 2 lug 5 (S-1).

- () Prepare the following wires:

3-1/4" black
3-1/2" white
4-1/4" white
9" white

Connect the prepared wires to SW1 as follows:

- () 3-1/4" black wire to wafer 2 lug 6 (S-1).
() 3-1/2" white wire to wafer 1 lug 8 (S-1).
() 4-1/4" white wire to wafer 1 lug 9 (S-1).
() 9" white wire to wafer 2 lug 9 (S-1).
() Twist a red and a green wire together to form a 5-1/2" twisted pair and prepare the wire ends.



PICTORIAL 2-2

Connect one end of the 5-1/2" red and green twisted wires to switch SW1 as follows:

- () Green wire to wafer 2 lug 1 (S-1) and the red wire to wafer 2 lug 3 (S-1).

Refer to Pictorial 2-2 for the following steps.

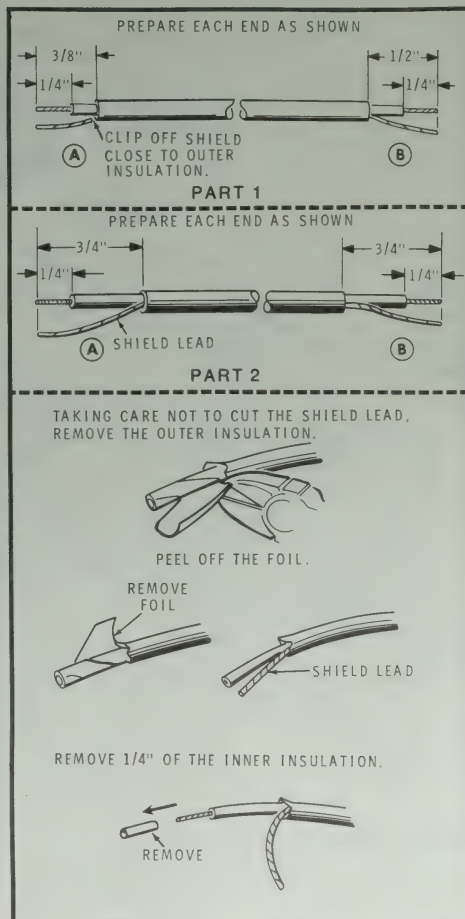
- () Refer to Detail 2-2A **Part 1** and prepare the following small shielded cables:

4-3/4"
2-3/4"

Connect the shielded cables to SW1 as follows:

- () 4-3/4" cable inner lead at end A to wafer 1 lug 4 (S-1).
- () 2-3/4" cable inner lead at end A to wafer 1 lug 10 (S-1).
- () Refer to Detail 2-2A **Part 2** and prepare the following small shielded cables:

5-1/4"
6"

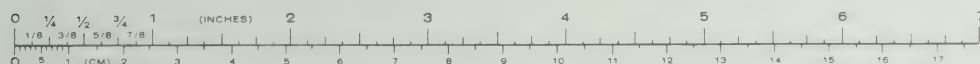


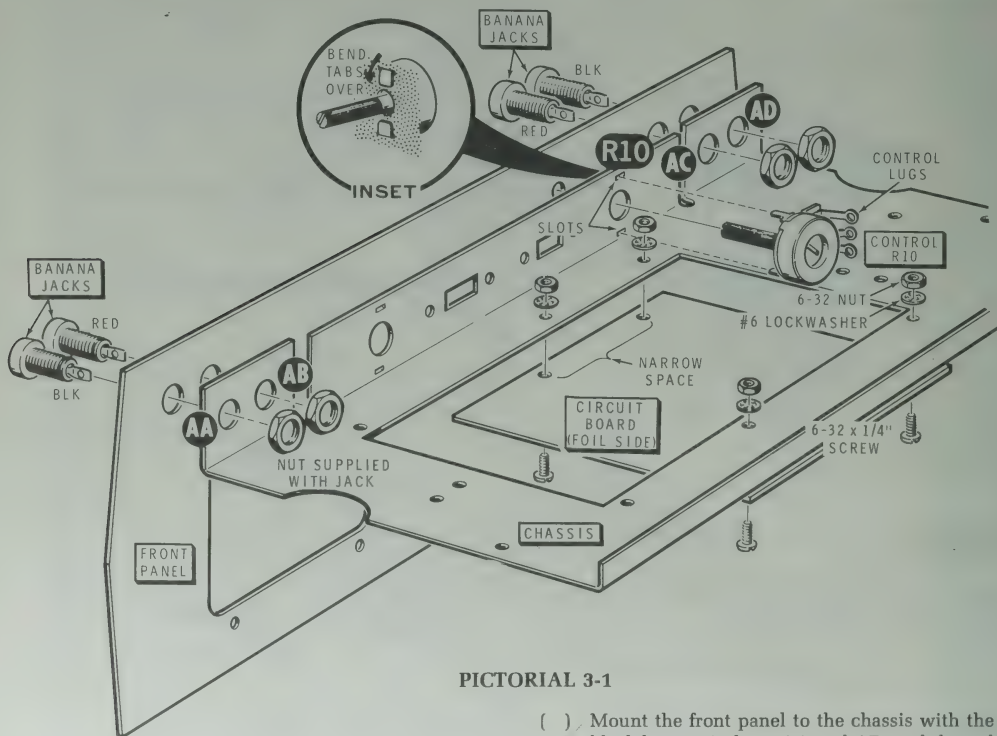
Detail 2-2A

Connect the shielded cables to SW1 as follows:

- () 5-1/4" cable inner lead at end A to wafer 2 lug 7 (S-1) and the shield lead to wafer 2 lug 10 (S-1).
- () 6" cable inner lead at end A to wafer 2 lug 8 (S-1) and the shield lead to wafer 2 lug 11 (S-1).

Set the switch aside.





PICTORIAL 3-1

CHASSIS ASSEMBLY AND WIRING

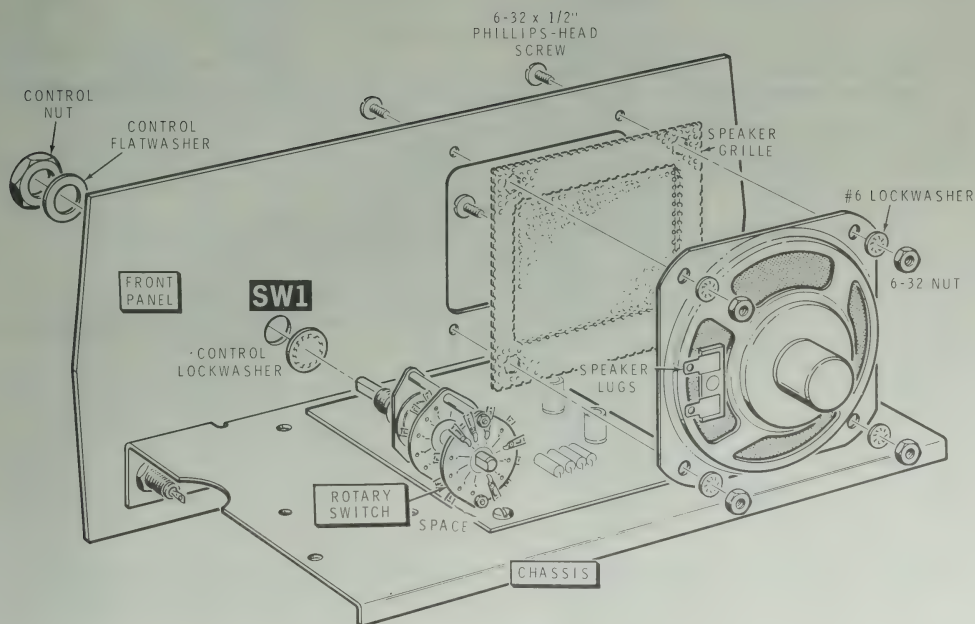
Refer to Pictorial 3-1 for the following steps.

- [] Position the chassis as shown.
- [] Mount the circuit board foil side up on the chassis as shown with four 6-32 × 1/4" screws, four #6 lockwashers, and four 6-32 nuts. Position the circuit board with the narrow space as shown.
- [] R10: Mount a 100 kΩ control (#10-299) on the chassis at R10. Insert the control tabs through the slots in the chassis and bend them over as shown in the inset drawing. Position the control lugs as shown.

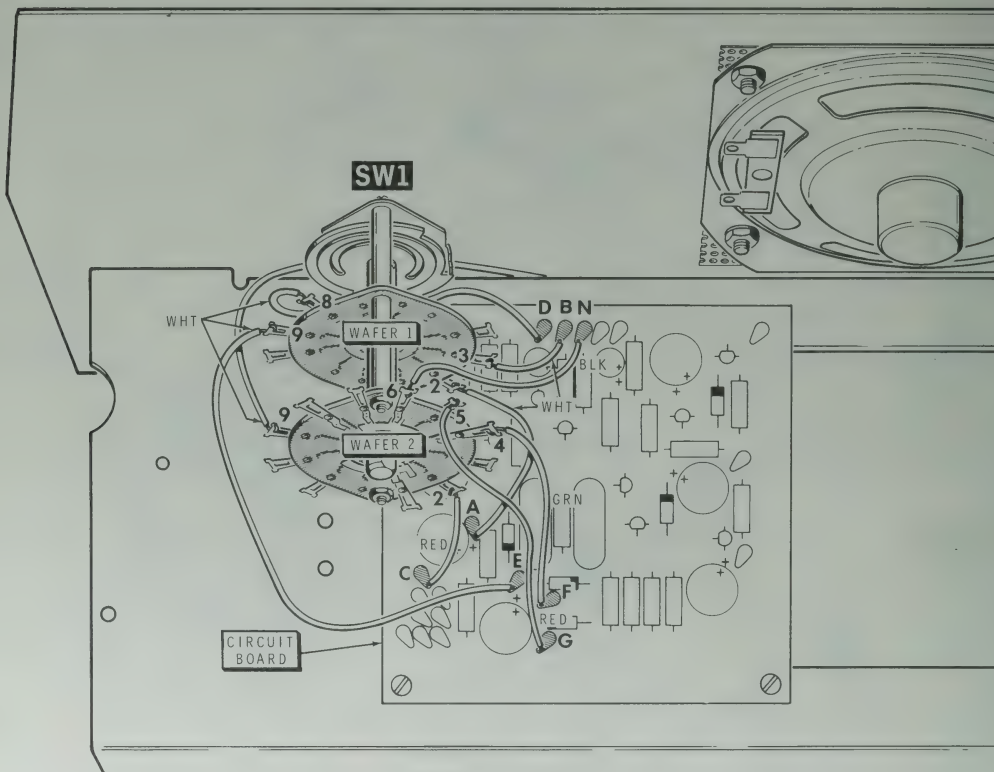
- [] Mount the front panel to the chassis with the black banana jacks at AA and AD, and the red banana jacks at AB and AC. Use the nuts supplied with the jacks. Make sure the control shaft of R10 does not bind.

Refer to Pictorial 3-2 for the following steps.

- [] Position the chassis as shown.
- [] Mount the speaker grille and speaker to the front panel with four 6-32 × 1/2" phillips-head screws, four #6 lockwashers, and four 6-32 nuts. Position the speaker lugs as shown.
- [] SW1: Mount the rotary switch (#63-1295) to the front panel at SW1 with a control lockwasher, a control flat washer, and a control nut. Position the switch lugs as shown.



PICTORIAL 3-2



PICTORIAL 3-3

Refer to Pictorial 3-3 for the following steps.

Connect the wires coming from SW1 to the circuit board as follows: Route each wire as shown.

- | | |
|--|---|
| <input type="checkbox"/> White wire coming from wafer 1 lug 2 to hole A (S-1). | <input type="checkbox"/> White wire coming from wafer 1 lug 9 to hole E (S-1). |
| <input type="checkbox"/> White wire coming from wafer 1 lug 3 to hole B (S-1). | <input type="checkbox"/> Red wire coming from wafer 2 lug 2 to hole C (S-1). |
| <input type="checkbox"/> White wire coming from wafer 1 lug 8 to hole D (S-1). | <input checked="" type="checkbox"/> Green wire coming from wafer 2 lug 4 to hole F (S-1). |
| | <input checked="" type="checkbox"/> Red wire coming from wafer 2 lug 5 to hole G (S-1). |

() Black wire coming from wafer 2 lug 6 to hole N (S-1).

() Route the white wire coming from wafer 2 lug 9 through the opening between the front panel and the chassis as shown. You will connect the free end later.

NOTE: The free end of the red and green twisted wires will also be connected later.

Refer to Pictorial 3-4 (Illustration Booklet, Page 2) for the following steps.

() Route the shielded cable coming from wafer 1 lug 4 through the opening between the front panel and the chassis as shown. Keep the cable over the top of the control shaft at R10. You will connect the free end of the cable later.

() Route the shielded cable from wafer 1 lug 10 as shown. You will connect the free end later.

() Connect the inner lead of the cable coming from wafer 2 lug 7 to speaker lug 1 (S-1) and the shield to speaker lug 2 (S-1).

() Connect the inner lead of the cable coming from wafer 2 lug 8 to circuit board hole L (S-1) and the shield lead to hole K (S-1).

() Connect the black lead of one battery connector to circuit board hole X (S-1) and the red lead to hole U (S-1).

() Connect the black lead of the remaining battery connector to circuit board hole R (S-1) and the red lead to hole S (S-1).

NOTE: The blue and white label in the next step shows the Model Number and Production Series Number of your kit. Refer to these numbers in any communications with the Heath Company; this assures you that you will receive the most complete and up-to-date information in return.

() Carefully peel the protective paper backing from the blue and white label and press the label onto the inside of the front panel as shown.

Refer to Pictorial 3-5 (Illustration Booklet, Page 2) for the following steps.

() Position the chassis as shown.

() Connect the inner lead of the shielded cable coming from wafer 1 lug 4 to the red banana jack at AC (S-1) and the shield lead to the black banana jack at AD (NS).

() Connect the inner lead of the shielded cable coming from wafer 1 lug 10 to control R10 lug 1 (S-1) and the shield lead to lug 3 (NS).

() Connect the free end of the white wire coming from wafer 2 lug 9 to the red banana jack at AB (S-1).

() Prepare the following black wires:

4-1/4"
2"

NOTE: When you connect a wire to the foil side of the circuit board, as in the following step, leave the insulation 1/8" away from the foil so the solder can flow around the bare wire as shown in the inset drawing.

() Connect the 4-1/4" black wire between the black banana jack at AA (S-1) and circuit board hole Z (S-1). Cut the excess lead length from the component side of the circuit board.

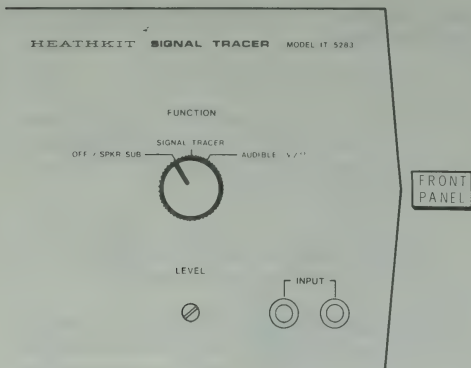
() Connect the 2" black wire between control R10 lug 3 (NS) and the black banana jack at AD (S-2).

() Cut a 3-1/2" small shielded cable. Remove 1/2" of outer insulation and 1/4" of inner insulation from both ends.

() Connect the inner lead of the 3-1/2" shielded cable to control R10 lug 2 (S-1) and the shield lead to lug 3 (S-3).

() Connect the inner lead at the other end of the 3-1/2" shielded cable to circuit board hole H (S-1) and the shield lead to hole J (S-1). Cut off the excess lead lengths from the component side of the circuit board.

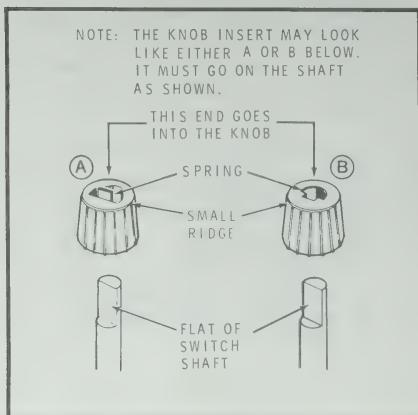




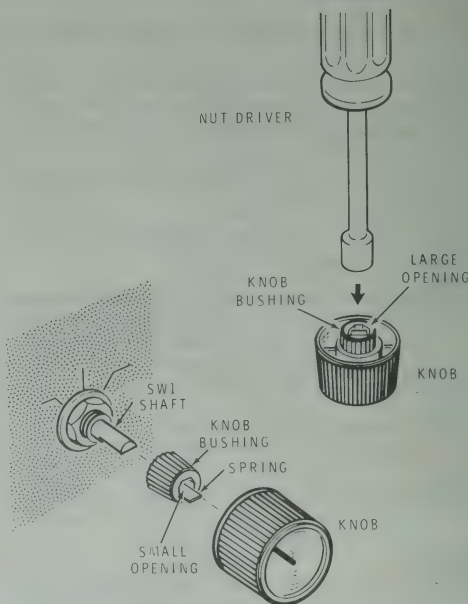
PICTORIAL 3-6

Refer to Pictorial 3-6 for the following steps.

- () Position the chassis as shown.
- () Refer to Detail 3-6A and push a knob bushing on switch shaft SW1. Face the small end of the bushing as shown.
- () Rotate the switch shaft completely counterclockwise.



Detail 3-6A



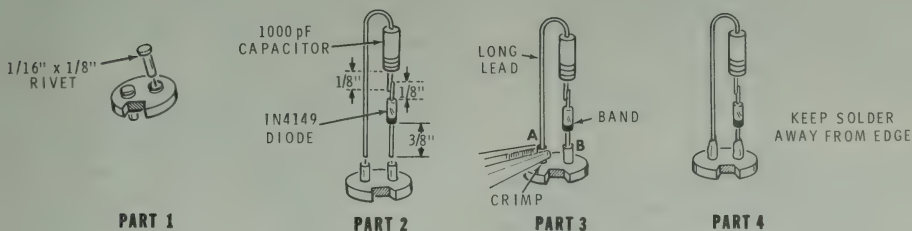
Detail 3-6B

Refer to Detail 3-6B and install the knob on the knob bushing in the following manner:

- () Line up the knob indicator with the OFF/SPKR SUB mark on the front panel.
- () Push the knob part way onto the bushing.
- () Carefully remove both the bushing and the knob. Do not allow the knob to come off the bushing.
- () Place the knob on a table or other firm surface. Place a soft cloth under the knob to prevent it from being marred. Then use a nutdriver or a large screwdriver and drive the bushing onto the knob.
- () Install the knob on the switch shaft at SW1.

Set the chassis aside.

This completes the "Chassis Assembly And Wiring."
Proceed to "Test Probe And Lead Assembly."



Detail 4-1A

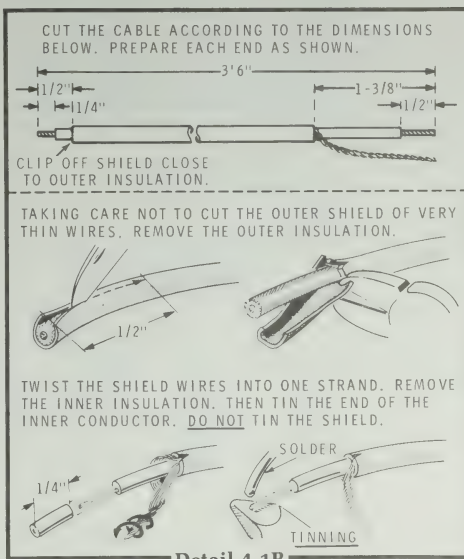
TEST PROBE AND LEAD ASSEMBLY

Refer to Pictorial 4-1 (Illustration Booklet, Page 3) for the following steps.

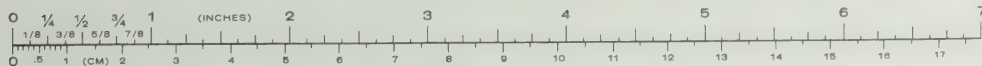
- () Refer to Detail 4-1A Part 1 and locate the probe insert insulator. If necessary, remove any "burrs" or sharp edges on the insert insulator with a file or penknife.
- () Locate the two $1/16" \times 1/8"$ rivets and insert them into the holes of the insert insulator. The head of each rivet should rest against the insert insulator. Now turn the insulator over and lay it flat on your workbench, being careful the rivets do not fall out of the holes.
- () C1, D1: Refer to Detail 4-1A Part 2 and locate the 1000 pF (brown-black-red-yellow or 102K) ceramic capacitor and the 1N4149 diode (56-56). Cut the lead at the banded end of the diode to $3/8"$ and the other lead to $1/8"$. Cut either lead (not both) of the 1000 pF capacitor to $1/8"$.
- () Apply a small amount of solder to the $1/8"$ leads (tinning) of both components. Place the tinned leads end to end and apply only enough heat to the two leads to melt the solder and solder the leads together.
- () Refer to Detail 4-1A Part 3 and bend the long capacitor lead over as shown. Position the long lead so the end is even with the short diode lead.
- () Squeeze the leads together so they line up with rivets A and B. Then insert the capacitor/diode combination into the rivets and crimp the rivets slightly with long-nosed pliers to hold the components in place.

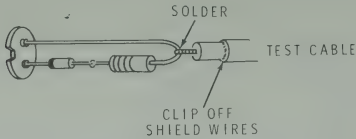
NOTE: Before you proceed further, check the position of the capacitor/diode combination on the insert insulator. The banded end of the diode should be at rivet B and the long capacitor lead at rivet A.

- () Refer to Detail 4-1A Part 4 and solder the component leads to the rivets. Make sure the components are square with the insert insulator and that the solder flows down into the rivets.
- () Refer to Detail 4-1B and prepare the large shielded cable as shown.



Detail 4-1B

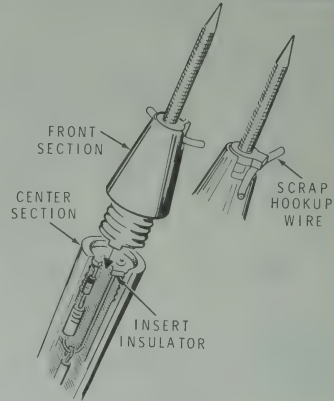




Detail 4-1C

- () Wrap the 1/2" end without the shield around the curved lead of the capacitor and solder the leads as shown in Detail 4-1C. Use only enough heat to provide a good connection. Be careful not to melt the inner insulator and cause a short in the cable.
- () Refer to Detail 4-1D and assemble the front section of the probe as follows:

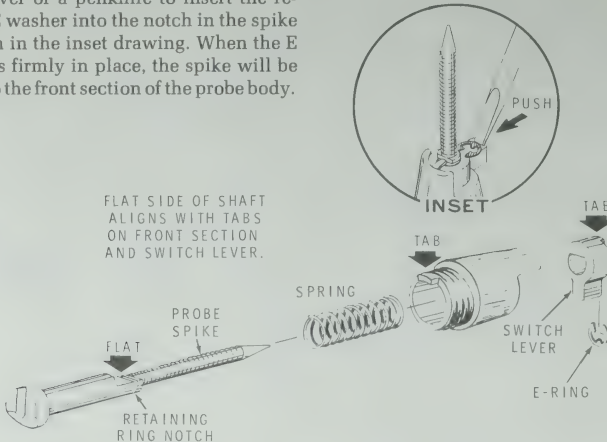
1. Remove any burrs on the probe spike.
2. Assemble the probe spike, the spring, the front section of the probe body, and the switch lever as shown. Push the switch lever flush against the front section of the probe body so the small retaining ring notch in the spike is exposed.
3. While holding the spike in firmly against the spring pressure with one hand, use a screwdriver or a penknife to insert the retaining E washer into the notch in the spike as shown in the inset drawing. When the E washer is firmly in place, the spike will be locked to the front section of the probe body.



Detail 4-1E

Refer to Detail 4-1E for the final assembly of the test probe.

- () Pull the switch lever forward against the spring tension and temporarily insert a scrap piece of hookup wire between the switch lever and the front section of the probe body.
- () Slip the center section of the probe body onto the shielded cable.



Detail 4-1D

- () Gently pull the shielded cable from the back of the center section and align the insert insulator flush with the front of the center section. Do not pull the insulator all the way into its shoulder seat.
- () Insert the tab on the front section of the probe body into the notch in the insert insulator. Hold the front section stationary and screw the center section onto the front section, thus pushing the insert insulator down to its final seat. **IMPORTANT:** The final probe assembly must be done in this manner; otherwise, the rivet heads and the front section of the probe will not make proper contact.
- () Remove the scrap hookup wire.

NOTE: If there is a gap between the front and middle sections, the tab is not properly seated in the notch and the last five steps must be repeated. Also, when the probe is properly assembled, the switch lever will noticeably "detent", or drop into place at both extreme switch positions.

- () Slip the rear section of the probe onto the cable and screw it onto the center section.

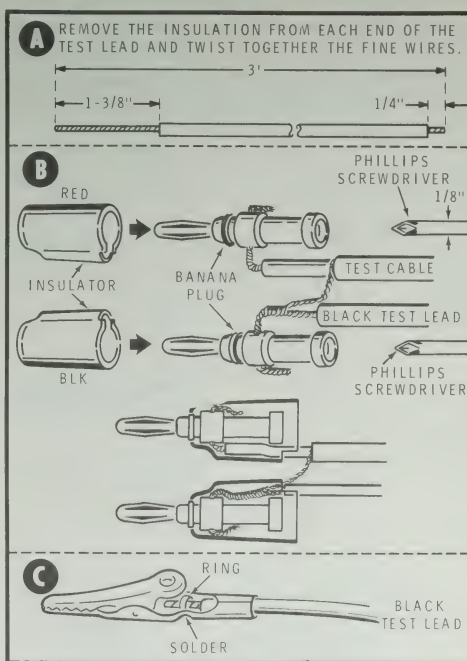
This completes the assembly of the test probe. You will assemble the test leads next.

Refer to Pictorial 4-2 for the following steps.

- () Refer to Part A and prepare the ends of the 3-foot black test lead as shown. Melt a small amount of solder on the 1/4" end only.
- () Refer to Part B and place the 1-3/8" stripped end of the black test lead alongside the shield lead on the test cable and twist the two leads tightly together to form a twisted pair.
- () Insert the twisted pair of wires into the hole of one of the banana plugs as shown.
- () Place the banana plug on a small phillips screwdriver (or similar tool) and push the black insulator over the banana plug and wire until the insulator snaps in place.

- () Insert the inner lead of the shielded cable into the remaining banana plug hole as shown. Slide the red plastic insulator over the plug as before.
- () Refer to Part C and insert the 1/4" end of the black test lead into the loop in the alligator clip and solder the lead in place.

This completes the "Test Probe and Lead Assembly." If you intend to use the Power Supply with your Signal Tracer, proceed to "Power Switch and Connector Wiring." If you have not purchased the power supply and intend to use batteries only, disregard the following steps and proceed to "Battery Only Wiring" on Page 25. You will need the leftover black, red, and green wire to modify your unit if you purchase the AC power supply later.



PICTORIAL 4-2



POWER SWITCH AND CONNECTOR WIRING

- () Locate the following parts from your Power Supply parts pack:

- 1 Slide switch (#60-2).
- 1 Mounting plate (#92-669).
- 3 Male connector pins (#432-72).
- 1 Connector shell with ears (#432-720).
- 2 6-32 \times 1/4" screws.

Refer to Pictorial 5-1 (Illustration Booklet, Page 3) for the following steps.

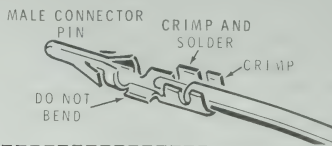
- () Prepare the following wires:

- 1-3/4" red
- 8" black
- 2-1/4" green

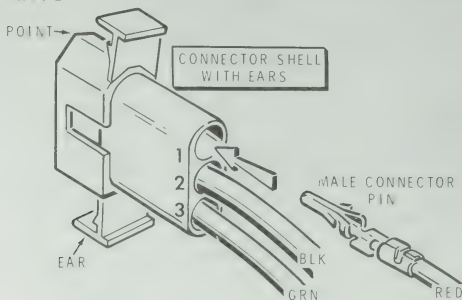
Refer to Detail 5-1A Part 1 and install a male connector pin on the following wires:

- () 1-3/4" red (S-1).
- () 8" black (S-1).
- () 2-1/4" green (S-1).

PART 1



PART 2



Detail 5-1A

Refer to Detail 5-1A Part 2 and position the connector shell with ears with the point as shown. Push the male connector pins into the holes as follows. NOTE: The connector pins will "click" as they lock into place.

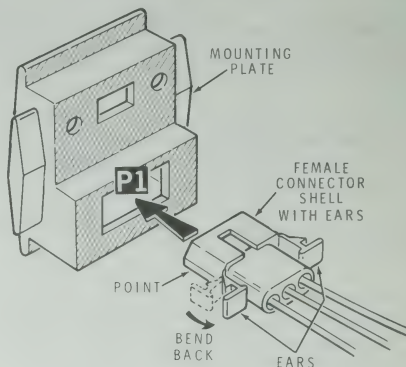
- () Red wire to hole 1.
- () Black wire to hole 2.
- () Green wire to hole 3.

Connect the free end of the wires coming from plug P1 as follows:

- () Red wire to switch SW3 lug 4 (S-1).
- () Black wire to circuit board hole Y (S-1).
- () Green wire to switch SW3 lug 3 (S-1).

Connect the free end of the 5-1/2" red and green twisted wires coming from SW1 lugs 1 and 3 to SW3 as follows:

- () Green wire to lug 2 (S-1) and the red wire to lug 5 (S-1).
- () Twist a red and a green wire together to form a 4" twisted pair and prepare the wire ends.



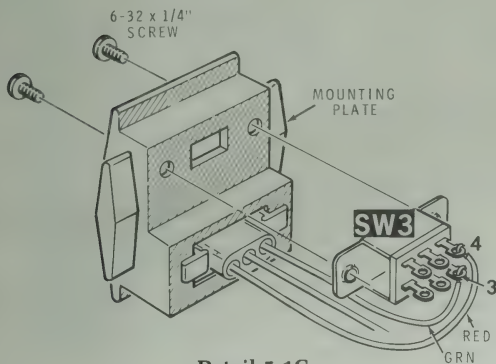
Detail 5-1B

Connect one end of the 4" red and green twisted wires to the circuit board as follows:

- () Green wire to hole P (S-1) and the red wire to hole T (S-1).

Connect the other end of the 4" red and green twisted wires to switch SW3 as follows:

- () Green wire to lug 1 (S-1) and the red wire to lug 6 (S-1).



Detail 5-1C

- () P1: Refer to Detail 5-1B and bend the ears of the connector shell back against the side of the body. Position the pointed end as shown. Push the connector shell into the mounting plate hole at P1. The ears will lock into place at the edge of the hole.

- () SW3: Refer to Detail 5-1C and install the slide switch on the mounting plate at SW3 with two 6-32 \times 1/4" screws. Position lugs 3 and 4 as shown.

This completes the "Step-by-Step Assembly." Proceed to "Initial Tests."

BATTERY ONLY WIRING

Refer to Pictorial 6-1 (Illustration Booklet, Page 3) for the following steps.

Connect the red and green twisted wires coming from wafer 2 lugs 1 and 3 to the circuit board as follows:

- () Red to hole T (S-1).
- () Green to hole P (S-1).

Proceed to "Initial Tests."

INITIAL TESTS

The purpose of this section of the manual is to make sure your Signal Tracer operates properly and will not be damaged as a result of a wiring error. A transistor, for example, could be destroyed instantly by a short circuit that causes excessive current.

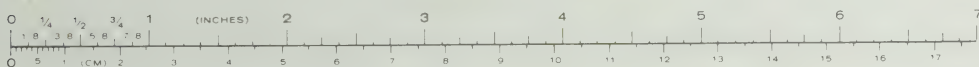
- () Inspect the Signal Tracer for improperly soldered connections, or connections that may be missed or unsoldered. Also check for solder bridges across two or more circuit board foils, which would cause a short circuit.
- () Examine the chassis mounted parts and make sure they are properly mounted and connected.

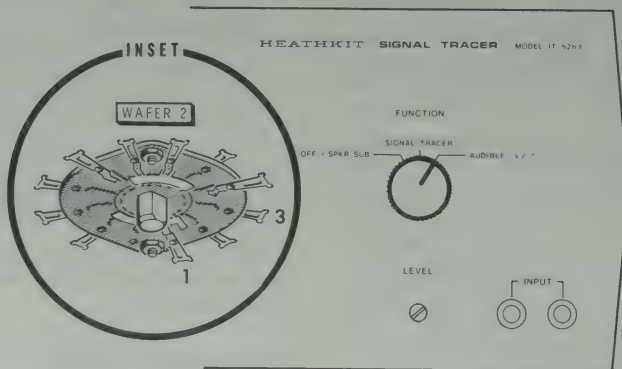
- () Make sure no bare wires are touching any components or the chassis.

RESISTANCE MEASUREMENTS

NOTE: If you have an ohmmeter, make the following resistance measurements. The readings may take a few seconds to reach the indicated settings due to the charging of capacitors in the circuit. If you do not have an ohmmeter, proceed to "Power Supply and Battery Connection" on Page 26.

- () Set your ohmmeter to read $R \times 100$.
- () Connect the common lead of your ohmmeter to the chassis.





PICTORIAL 6-2

NOTE: The readings in the following steps are the minimum desired. If the readings you obtain are significantly less, you must determine the reason (such as a short circuit between the circuit board foils caused by a solder bridge) and correct it before you proceed.

Refer to Pictorial 6-2 for the following steps.

- (☒) Place the FUNCTION switch in the AUDIBLE V/Ω position.
- (☒) Touch the ohmmeter probe to wafer 2 lug 1 of switch SW1. The reading should be 5 kΩ or higher.
- (☒) Touch the ohmmeter probe to wafer 2 lug 3 of switch SW1. The reading should be 10 kΩ or higher.

Place the FUNCTION switch to OFF/SPKR SUB.

This completes the "Resistance Measurements."

NOTE: If you intend to use the Power Supply with your Signal Tracer, proceed to "Power Supply and Battery Connection." If you did not purchase the Power Supply and intend to use batteries instead, refer to "Battery Connection."

POWER SUPPLY AND BATTERY CONNECTION

Refer to Pictorial 6-3 (Illustration Booklet, Page 4) for the following steps.

- () Position the Signal Tracer as shown.
- () Connect one of the five connector shells coming from the Power Supply to plug P1 on the signal tracer mounting plate. Make sure the wire colors at both connectors match and are not reversed.
- () Place the LINE/BATT switch to the LINE position.
- () Plug the power supply line cord into the appropriate AC receptacle.

BATTERY CONNECTION

NOTE: If you intend to use batteries in addition to the Power Supply, proceed with the following steps. Otherwise, proceed to "Hum Injection Test."

- () Connect the two 9-volt batteries, which you purchased earlier, to battery connectors BC1 and BC2.
- () If you use batteries only, place the LINE/BATT switch to BATT.

Proceed to "Hum Injection Test."

HUM INJECTION TEST

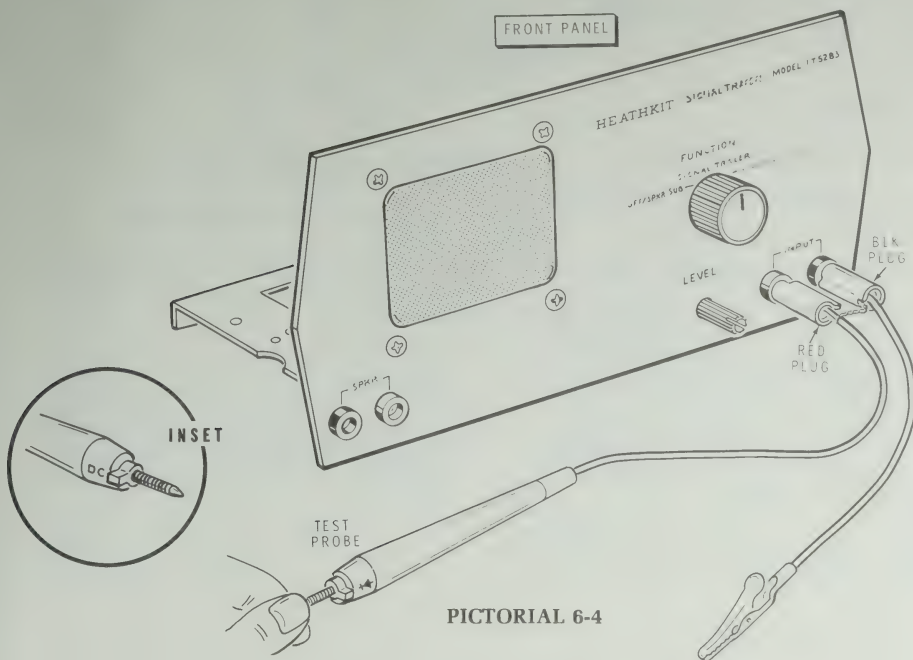
Refer to Pictorial 6-4 for the following steps.

NOTE: If you do not obtain the proper results during the following tests, refer to "In Case of Difficulty" to help you correct the problem. Do not proceed with any other steps until you correct the problem.

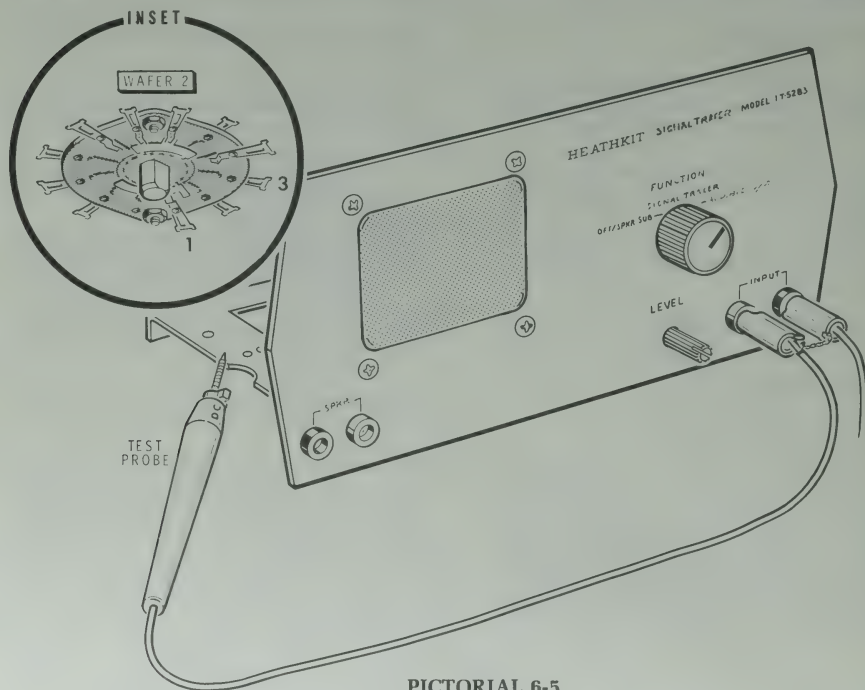
- () Turn the LEVEL control fully counterclockwise.

- () Plug the test probe into the INPUT jacks in the front panel.
- () Place the test probe switch in the DC position as shown in the inset drawing.
- () Turn the FUNCTION switch to the SIGNAL TRACER position.
- () Wait a few seconds for the unit to stabilize, then turn the LEVEL control clockwise until you hear hum from the speaker. NOTE: Do not turn the LEVEL control higher than necessary if you are using batteries, since battery drain increases with volume.
- () Touch the end of the test probe with your fingers; the hum level should increase.
- () Grasp the probe by the spike and turn the probe switch to the (→←) position. The hum should change in tone slightly. If this does not happen, check the probe switch assembly or wiring. Refer to Detail 4-1F.

Proceed to "Oscillator Test."



PICTORIAL 6-4



PICTORIAL 6-5

OSCILLATOR TEST

Refer to Pictorial 6-5 for the following steps.

- () Turn the FUNCTION switch to the AUDIBLE V/ Ω position.
- () Turn the test probe switch to the DC position.
- () Touch the test probe spike to the chassis. You should hear a tone from the speaker. If this does not happen, check the probe switch assembly or wiring. Refer to Pictorial 4-1 (Illustration Booklet, Page 3).
- () Refer to the inset drawing and touch the test probe to wafer 2 SW1 lug 3. You should hear a tone, higher in frequency.
- () Turn the test probe switch to the (→|←) position. Touch the test probe spike to the chassis. You should not hear a tone.

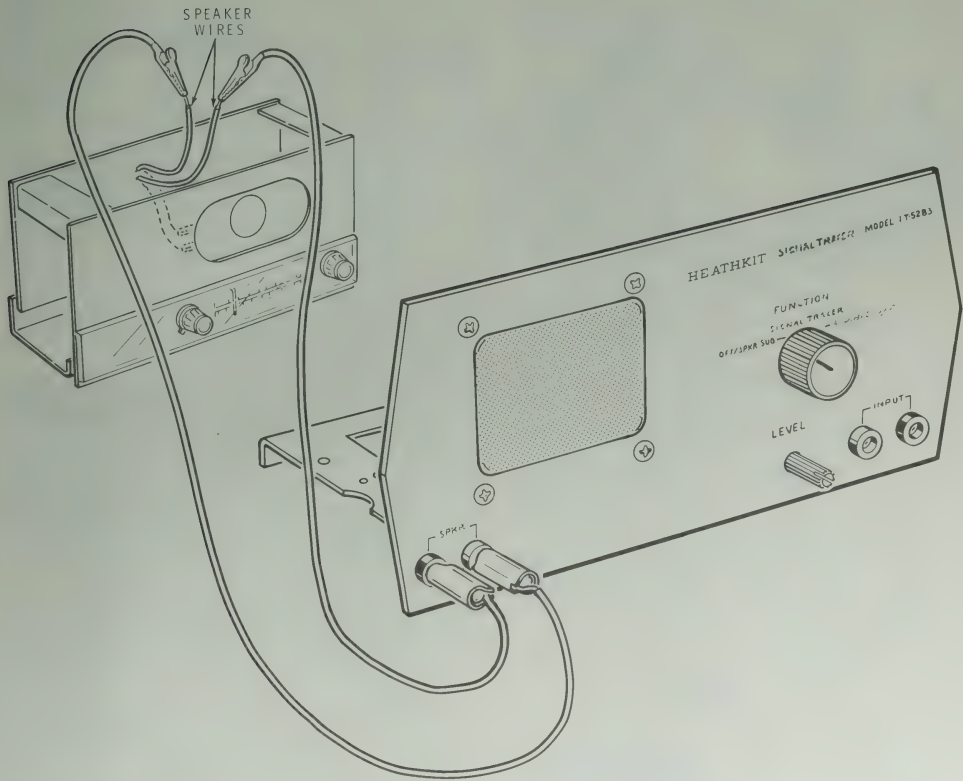
Proceed to "Speaker Substitution Test."

SPEAKER SUBSTITUTION TEST

Refer to Pictorial 6-6 for the following steps.

NOTE: The following test uses a radio as an example. You may, however, substitute any unit that would use a substitution speaker.

- () Turn the FUNCTION switch to the OFF/SPKR SUB position.
- () Disconnect the speaker wires in the radio from the speaker terminals. NOTE: If you are using an AC line-operated radio, make sure it is not plugged in.

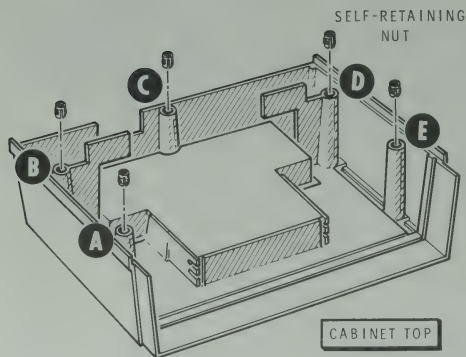


PICTORIAL 6-6

- () Connect the speaker wires from the radio to the SPKR jacks on the Signal Tracer front panel. You may use a pair of clip leads to connect the radio to the Signal Tracer. Refer to the Pictorial for the proper connections.
- () Plug the radio into an AC outlet (if necessary) and turn it on. The sound will come from the speaker in the Signal Tracer.
- () Turn the radio off and unplug it (if necessary). Disconnect the clip leads from the radio and reconnect the speaker wires to the radio speaker terminals.

This completes the "Initial Tests." Proceed to "Final Assembly."

FINAL ASSEMBLY



PICTORIAL 7-1

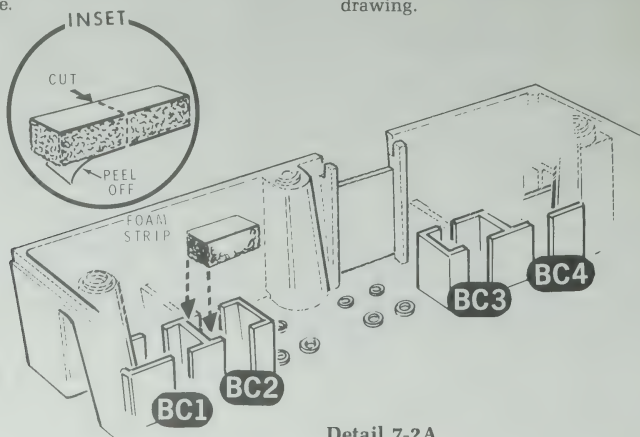
Refer to Pictorial 7-1 for the following steps.

- () Position the cabinet top as shown.
- () Install five self-retaining nuts at A, B, C, D, and E. Insert the slotted end of the nuts into the cabinet posts and press the nuts into the holes. Use a nut driver or similar tool to drive the nuts into the holes flush with the top.

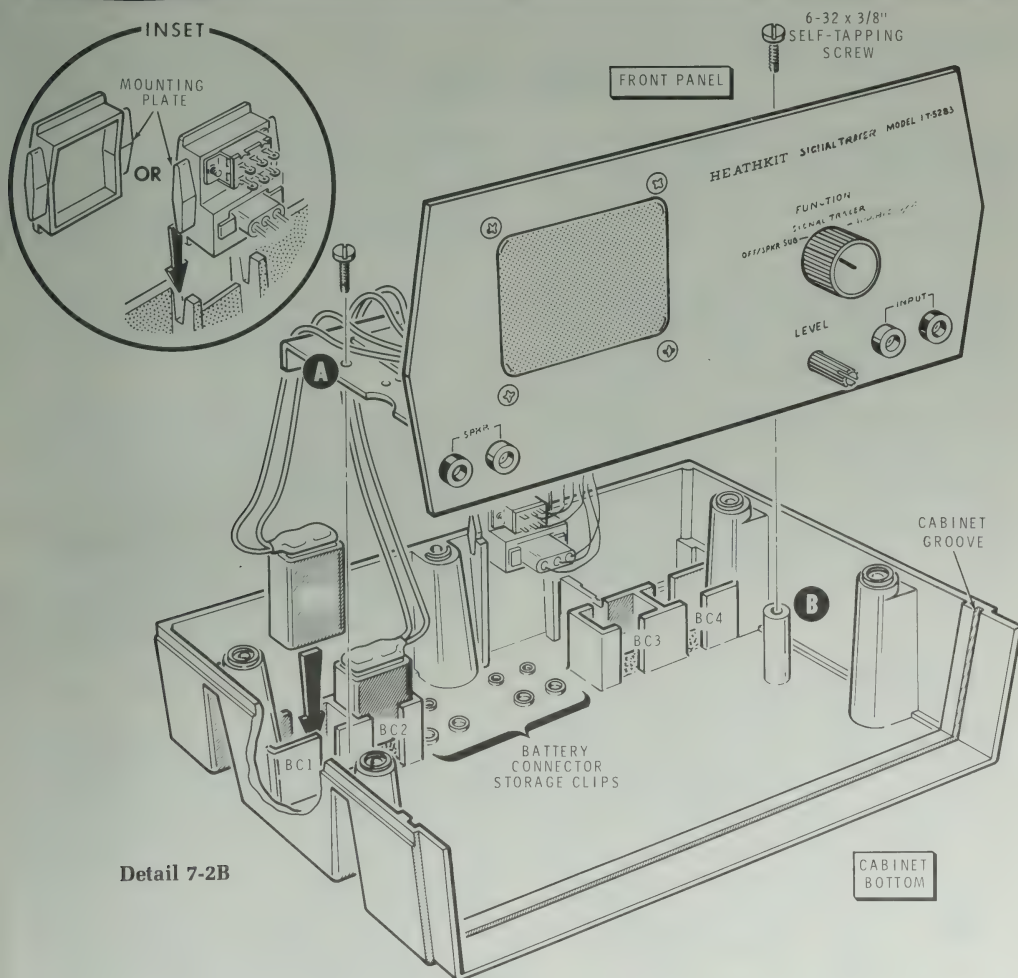
Set the cabinet top aside.

Refer to Pictorial 7-2 (Illustration Booklet, Page 4) for the following steps.

- () Position the cabinet bottom as shown.
- () Refer to Detail 7-2A and cut a 2" piece of double-stick foam tape in half. Then remove the paper backing from one side of both halves. Press the double-stick foam tape into battery compartments BC1 and BC2.
- () In a like manner, prepare the remaining 2" piece of double-stick foam tape and install the tape in battery compartments BC3 and BC4.
- () Refer to Detail 7-2B and mount the Signal Tracer in the cabinet bottom at A and B with two 6-32 \times 3/8" self-tapping screws. If you use batteries with the Signal Tracer, install them in compartments BC1 and BC2 as shown. NOTE: You may store spare batteries in compartments BC3 and BC4. If you do not use batteries, press the battery connectors onto the battery connector storage clips in the cabinet bottom.
- () Install either mounting plate in the rear opening of the cabinet bottom as shown in the inset drawing.



Detail 7-2A



Detail 7-2B

() Install the cabinet top on the cabinet bottom. Make sure the front panel slides into the groove properly.

() Install five 6-32 \times 1/2" screws through the cabinet bottom.

Detail 7-2C (Illustration Booklet, Page 4) shows you how to store cables and accessories for your Signal Tracer in the cabinet top compartment.

This completes the "Final Assembly." Proceed to "Operation."



OPERATION

The Signal Tracer is one of the simplest, most effective instruments for rapid troubleshooting in radio and TV circuits. It is the "untuned" type which makes it simple to operate and also means that you will have to change control settings less often.

This instrument has a number of useful applications to help you quickly locate and diagnose the trouble in the circuit under test. You should become familiar with the different phases of the instrument's operation so that you will get the maximum benefit from it.

The procedures outlined in this section of the Manual are of a general nature, and do not represent the limits of its applications. As you use the instrument, you will develop your own procedures and applications.

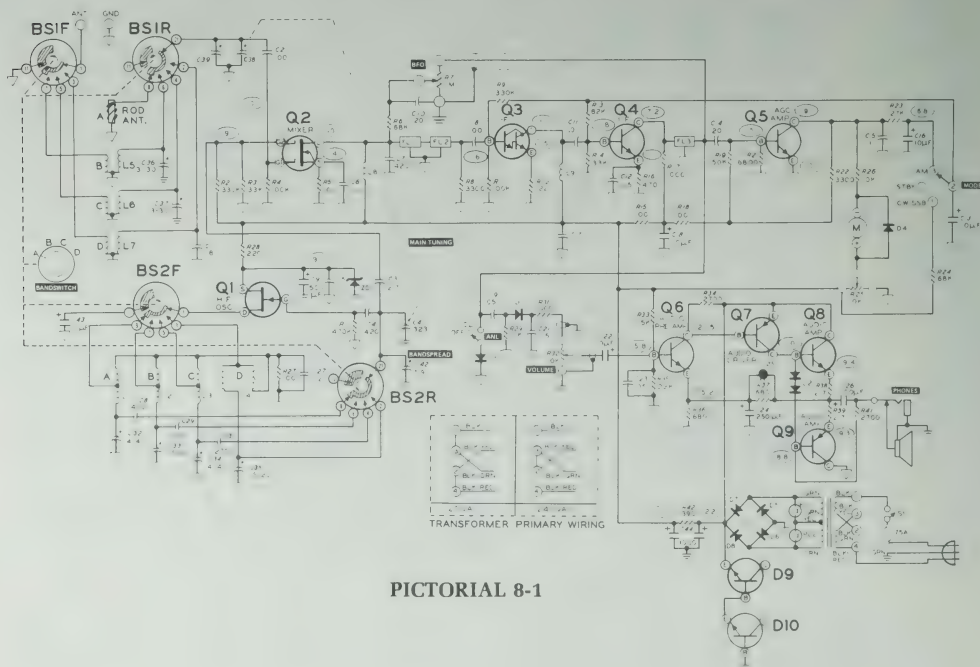
NOTE: If you use batteries to power your Signal Tracer, do not turn the level control any higher than necessary since the higher the volume is set, the faster the batteries will discharge.

RF SIGNAL TRACING

When you use the Signal Tracer for RF signal tracing, turn the probe switch to the (→) position, and the FUNCTION switch to the SIGNAL TRACER position. Adjust the LEVEL control no higher than necessary.

NOTE: At near maximum settings of the LEVEL control, a certain amount of hum is present. This is due to the high sensitivity of the Signal Tracer which permits it to pick up stray AC fields.

To illustrate the use of the instrument, a typical radio schematic is presented in Pictorial 8-1 so the test points may be clearly pointed out. Assume that the receiver under test has a specific problem of low volume. Since the radio is not completely dead, it can be turned on and tuned to a station. The volume control should be turned down so the radio's output does not interfere with the Signal Tracer's output. The black test lead of the probe should be clipped to the chassis or ground circuit of the radio. If the radio is tuned to a



PICTORIAL 8-1

strong station, and the probe is connected, a signal should be present at the rod antenna, the tuning capacitor, and G1 of FET Q2. On some radios, the hum overrides the signal, which makes it necessary to move the probe to the 1st IF stage (base of transistor Q3), in order to check the operation of the first stage.

You can trace the path of the signal through the succeeding IF stages to the detector. During these tests, you can estimate the gain per stage. The amount of gain that can be expected in a circuit can best be determined by reference to manufacturer's specifications or by previous experience in making similar tests.

In some cases the RF probe causes a slight detuning effect when you apply it to tuned circuits. In these cases, advance the test probe to the next test point. If a good signal is present, it is reasonable to assume that the preceding stage is functioning properly.

You can use the same general procedure in checking RF and IF stages in TV and FM circuits. Since the actual signal is most important, the Signal Tracer will detect the presence or absence of the signal regardless of the type of circuit involved.

AUDIO SIGNAL TRACING

After the signal has gone through the detector (diode D1) in the radio, the RF probe is not required. Turn the probe switch to the DC position. Here again, the same general conditions apply as described previously. After the detector stage, you can trace the signal through the audio stages (transistors Q6, Q7, Q8, and Q9), to the speaker. These tests can be made quickly and easily and any circuit fault will be indicated by a loss of gain or signal in succeeding stages. You can also spot intermittent or faulty volume controls or coupling capacitors. When you use the Signal Tracer, keep in mind that it will detect the presence as well as the absence of a signal. For example, it is common practice to use a high capacity by-pass capacitor in the audio output circuit. If the capacitor is open, there

will be a definite indication of a signal at the by-pass capacitor, whereas a good capacitor will pass the signal to ground in the desired manner.

As you trace the signal through the audio circuit, the signal will be very high, so reduce the LEVEL control on the Signal Tracer.

TEST SPEAKER

In service work, it is sometimes necessary to take the chassis of a radio or TV to the repair shop to complete the repair work. In many instances, the speaker is separate, and may be rather inaccessible. The circuit may specify a permanent magnet type speaker. If so, you can substitute the Signal Tracer's speaker in these cases. When the FUNCTION switch is in the OFF/SPKR SUB position, the speaker in the Signal Tracer is disconnected from the tracer circuitry and connected to the front panel jacks. Thus, the radio or TV speaker wires are connected directly to these jacks. This feature eliminates the need to remove and reinstall the speaker on every service job.

AUDIO SYSTEMS

Quite frequently, service technicians may service automatic record changers or phono mechanisms. When mechanical repairs or adjustments are made on the changer mechanism, they may want to check the output of the phono cartridge. By connecting the INPUT of the Signal Tracer to the output of the record changer, the changer's output can be heard in the speaker of the Signal Tracer. Any irregularity in mechanical operation, such as turntable wow or thump, or any objectionable noise that could be transmitted through the phono cartridge and reproduced as an undesirable condition, will be heard in the Signal Tracer's speaker.

You can also use the same procedure in checking microphones and musical instrument pickups. Generally the Signal Tracer will check any equipment which requires an audio system.

LOGIC TRACER

When you place the probe switch in the DC position and the FUNCTION switch in the AUDIBLE V/ Ω position, an "audible voltmeter" is created. This circuit could also be called an "audible ohmmeter," since it will respond to either changing voltage or resistance. When you touch the probe tip to the black test lead alligator clip (ground), an audible tone is produced in the speaker. As you increase the voltage or decrease the resistance, the frequency of the tone increases. As you decrease the voltage or increase the resistance, the frequency of the tone decreases. The Signal Tracer's circuitry will respond to voltages from approximately -3 volts to $+20$ volts DC, and to resistance from 0 Ω to 5 M Ω .

When you signal trace a logic circuit, apply a slow square wave of 4 or 5 Hz. NOTE: Apply the probe directly to the generator's output to become familiar with the tone produced. Move to each succeeding stage throughout the logic circuitry until you no longer hear the familiar pattern, or until you detect a change in the frequency of the tone. While you become familiar with the Logic Tracer, frequent references to ground and the supply voltage will help you remember what to listen for with regard to "logic 1" and "logic 0" tones.

IN CASE OF DIFFICULTY

This part of the Manual provides you with information that will help you locate and correct difficulties which may occur in your Signal Tracer. This information is divided into two sections. The first section, "General," contains suggestions of a general nature in the following areas:

- Visual check and inspection.
- Precautions to observe when bench testing.

The second section is a "Troubleshooting Chart" which contains a series of "Conditions" and "Possible Causes." Start your troubleshooting procedure by first reading the following "General" section. Then proceed to the appropriate "Condition" and "Possible Cause."

GENERAL

Visual Checks

1. About 90% of the kits that are returned for repair do not function properly due to poor soldering. Therefore, you can eliminate many troubles by a careful inspection of connections to make sure they are soldered as described in the "Soldering" section of the "Assembly Notes." Reheat any doubtful connections and be sure all the wires are soldered at places where several wires are connected. Check carefully for solder bridges between circuit board foils.

2. Check to be sure that all transistors are in their proper locations, and are installed correctly.
3. Check the value of each part. Be sure that the proper part has been wired into the circuit, as shown in the Pictorial diagrams and as called out in the wiring instructions. It would be easy, for example, to install a 2200 Ω (red-red-red) resistor in a step that calls for a 1200 Ω (brown-red-red) resistor.
4. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as you check it. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you have consistently overlooked.
5. Check all component leads connected to the circuit boards. Make sure the leads do not extend too far through the circuit board and make contact with other connections or parts.
6. Check all of the wires that are connected to the circuit board to be sure the wires do not touch the chassis. Make sure all wires are properly soldered.
7. If the difficulty still is not cured, read the "Precautions for Bench Testing," then refer to the "Troubleshooting Chart."

Precautions for Bench Testing

- Be cautious when you test transistors. Although they have almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage and current than other circuit components.
- Be careful so you do not short any terminals to ground when you make voltage measurements. If the probe slips, for example, and shorts out a bias or voltage supply point, it may damage one or more components.

Do not remove any components from the circuit board while the Signal Tracer is turned on.

When you make repairs to the Signal Tracer, make sure you eliminate the cause as well as the effect of the trouble. If, for example, you find a damaged resistor, make sure you find out what (wiring error, etc.) caused the resistor to become damaged. If the cause is not eliminated, the replacement resistor may become damaged when the tracer is put back into operation.

Refer to the "X-Ray Views," "Identification Charts," and the "Schematic Diagram" to locate the various components.

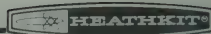
Use a high impedance voltmeter to make the specified measurements in this section.

In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your warranty is located inside the front cover.

Troubleshooting Chart

This chart lists the "Condition" and "Possible Cause" of specific malfunctions. If a particular part or parts are mentioned (Q1 for example) as a possible cause, check that part to see if it was installed and/or wired correctly. It is also possible, on rare occasions, for a part to be faulty and require replacement.

CONDITION	POSSIBLE CAUSE
No sound from the speaker.	<ol style="list-style-type: none"> 1. Defective speaker. 2. Q4 through Q8 installed incorrectly. 3. D6, D7 installed backwards. 4. C7 open.
No operation in Audible V/Ω position, Signal Tracer OK.	<ol style="list-style-type: none"> 1. Q3 installed incorrectly. 2. D4, D5 installed backwards.
No operation in Signal Tracer position, Audible V/Ω OK.	<ol style="list-style-type: none"> 1. Q1, Q2 installed incorrectly. 2. D2, D3 installed backwards.
No detection or weak detection on RF signals.	<ol style="list-style-type: none"> 1. D1 installed backwards. 2. Probe switch in wrong position. 3. Probe switch wired incorrectly.



SPECIFICATIONS

Functions	Speaker substitution (16 Ω). Audio or RF signal tracing. Audible volt/ohmmeter.
Speaker	3" permanent magnet, 16 Ω
Power Supply	Two 9-volt batteries, and/or Heathkit Model IPA-5280-1 Power Supply.
Cabinet Dimensions	11" wide \times 5-3/4" high \times 7-3/4" deep (27.9 \times 14.6 \times 19.7 cm).
Net Weight	3lbs. (1.4 kg).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram (Illustration Booklet, Page 5) while you read this circuit description.

The Signal Tracer is basically a hi-gain amplifier. It features a diode-equipped probe which acts as an RF detector. A relaxation oscillator provides an audible volt/ohmmeter function.

A high-impedance input stage is formed by transistors Q1 and Q2 which are connected in a complementary amplifier configuration. The stage also provides a voltage gain. The high impedance is a function of the Darlington transistor, Q1. Diodes D2 and D3 provide input voltage protection. Diode D1, which is located in the probe, can be switched in to provide detector action in RF circuits. Capacitor C1, which is in series with diode D1, blocks any DC present on the RF signal.

The audible volt/ohmmeter (logic tracer) circuit is provided by unijunction transistor Q3, which is connected as a relaxation oscillator. The circuit charges capacitor C10 to the "firing potential" of transistor Q3, at which time the transistor conducts and discharges C10. This discharge provides a pulse to the audio amplifier through capacitor C4. Any voltage

above the firing voltage of transistor Q3 (normally 4 to 6 volts) will be sufficient to operate the circuit. Since this circuit returns to -9 volts, voltage levels down to approximately -3 volts can be determined. The audible ohmmeter functions when the probe tip is touched to the test point. The frequency of the tone produced will vary when more or less resistance is inserted in series with the probe.

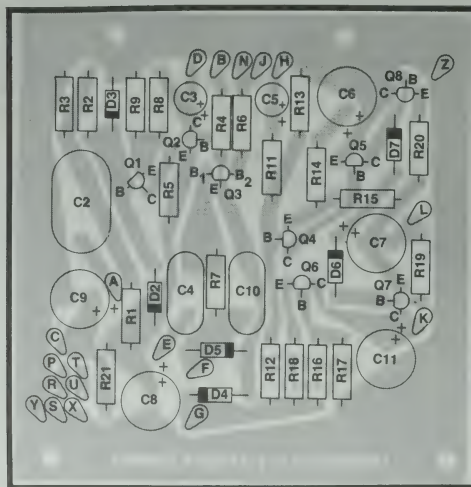
Function switch SW1 selects either the audio preamplifier (signal tracer) or the relaxation oscillator Q3 (Audible V/ Ω). SW1 connects the signal to the audio amplifier through Level control R10 and coupling capacitor C5. Transistor Q4 is an audio amplifier which connects the amplified signal directly to the base of the audio driver, Q5. The amplified signal from Q5 is connected directly to the complementary output stage, which consists of transistors Q7 and Q8, and diodes D6 and D7.

Transistor Q6 acts as a current limiter to prevent current drain on the batteries. Resistor R21 and capacitors C8 and C9 provide power supply isolation between the preamplifier and power amplifier circuitry. The Signal Tracer may be powered by batteries or the optional power supply, Model IPA-5280-1.

CIRCUIT BOARD X-RAY VIEW

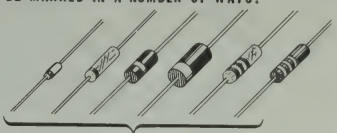
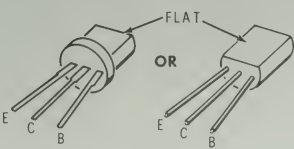
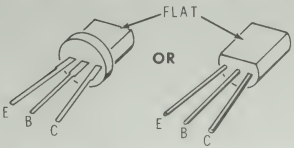
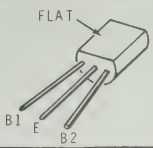
NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

- A. Find the circuit component number (R5, C3, etc.) on the X-Ray View.
- B. Locate this same number in the "Circuit Component Number" column of the "Parts List" in the front of this Manual.
- C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



VIEWED FROM COMPONENT SIDE

SEMICONDUCTOR IDENTIFICATION CHART

SCHEMATIC NUMBER	HEATH PART NUMBER	MANUFACTURER'S NUMBER	LEAD IDENTIFICATION
D1, D2, D3, D4, D5	56-56	IN4149	<p>IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.</p>  <p>BANDED END</p>
D6, D7	57-65	IN4002	
Q1	417-222	2N5308	
Q2, Q4 Q6, Q8	417-235	2N4121	
Q5, Q7	417-801	MPSA20	
Q3	417-285	2N4893	

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE**INSTRUCTIONS**

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (\$1.00 minimum, \$5.00 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

Total enclosed \$ _____

- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # _____ Invoice # _____

Date _____ Location _____

Purchased _____ Purchased _____

LIST HEATH PART NUMBER	QTY	PRICE EACH	TOTAL PRICE

TOTAL FOR PARTS

HANDLING AND SHIPPING

MICHIGAN RESIDENTS ADD 4% TAX

TOTAL AMOUNT OF ORDER

SEND TO **HEATH COMPANY**
BENTON HARBOR
MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
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TOTAL FOR PARTS

HANDLING AND SHIPPING

MICHIGAN RESIDENTS ADD 4% TAX

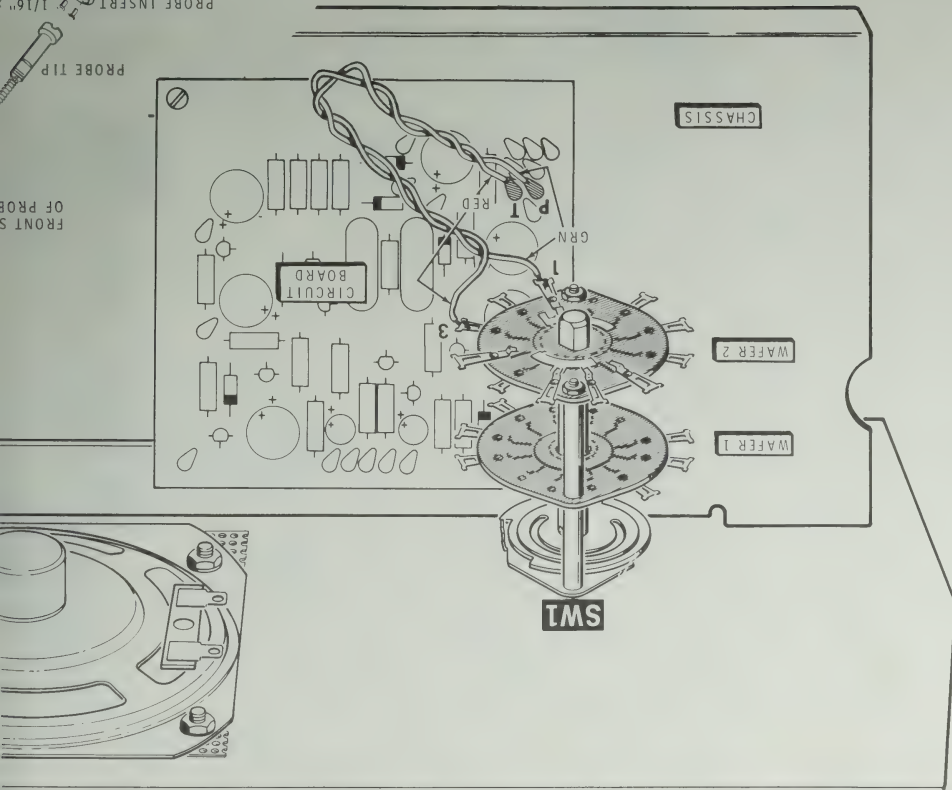
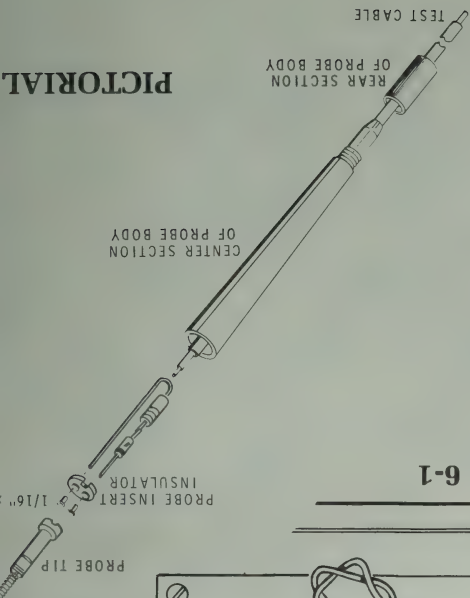
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Phone (Replacement parts only): 616 982-3571

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CUT ALONG DOTTED LINE



PICTORIAL 6-1

PICTORIAL

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE**INSTRUCTIONS**

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CITY _____

STATE _____ ZIP _____

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Model # _____ Invoice # _____

Date _____ Location _____

Purchased _____ Purchased _____

LIST HEATH PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE

TOTAL FOR PARTS

HANDLING AND SHIPPING

MICHIGAN RESIDENTS ADD 4% TAX

TOTAL AMOUNT OF ORDER

SEND TO: **HEATH COMPANY**
BENTON HARBOR
MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

FOR PARTS REQUESTS ONLY

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Total enclosed \$ _____

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NAME _____

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CITY _____

STATE _____ ZIP _____

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Model # _____ Invoice # _____

Date _____ Location _____

Purchased _____ Purchased _____

LIST HEATH PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE

TOTAL FOR PARTS

HANDLING AND SHIPPING

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TOTAL AMOUNT OF ORDER

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ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

CUT ALONG DOTTED LINE

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance, you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least **THREE INCHES** of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022



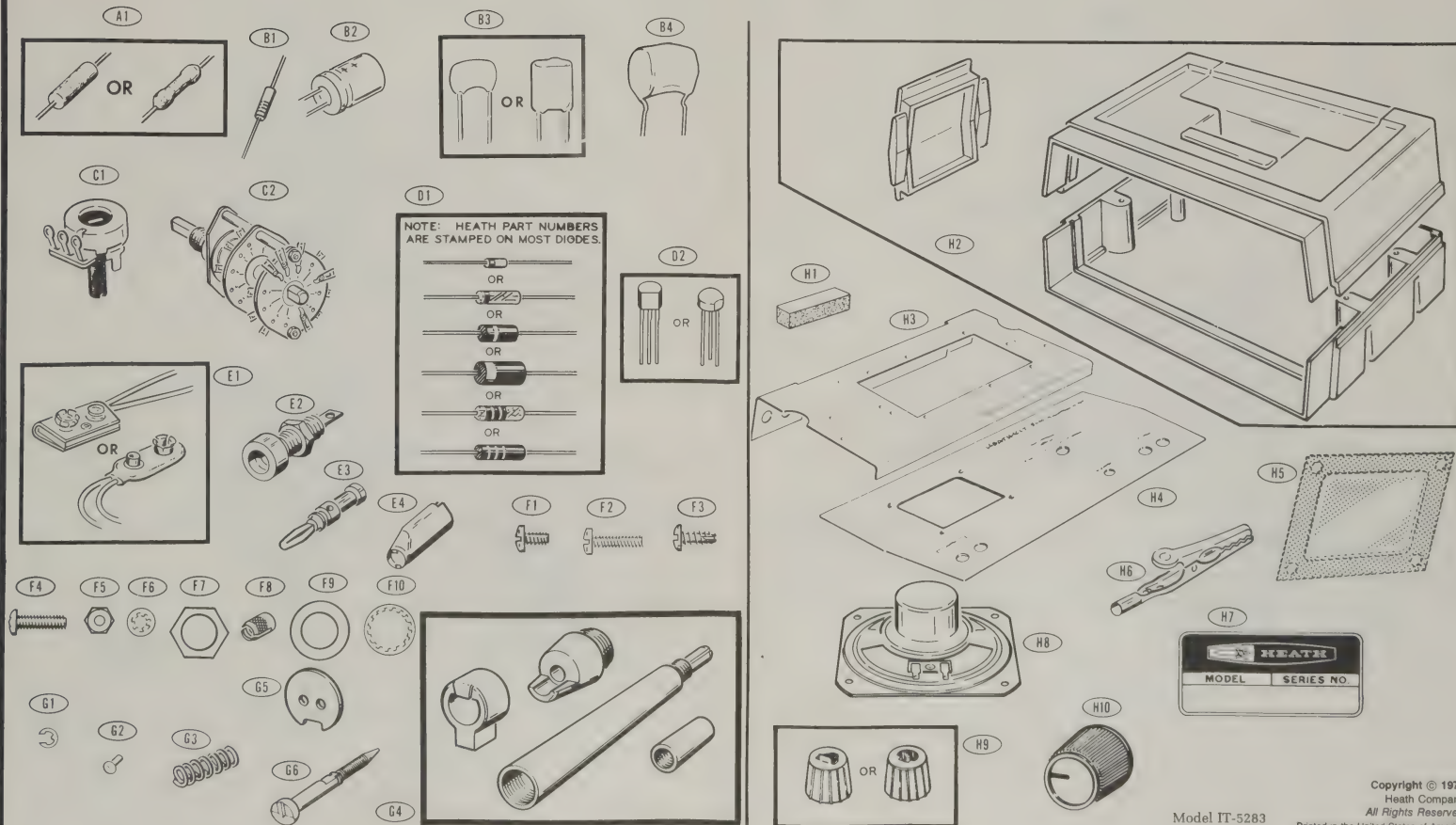
HEATH COMPANY • BENTON HARBOR, MICHIGAN
THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

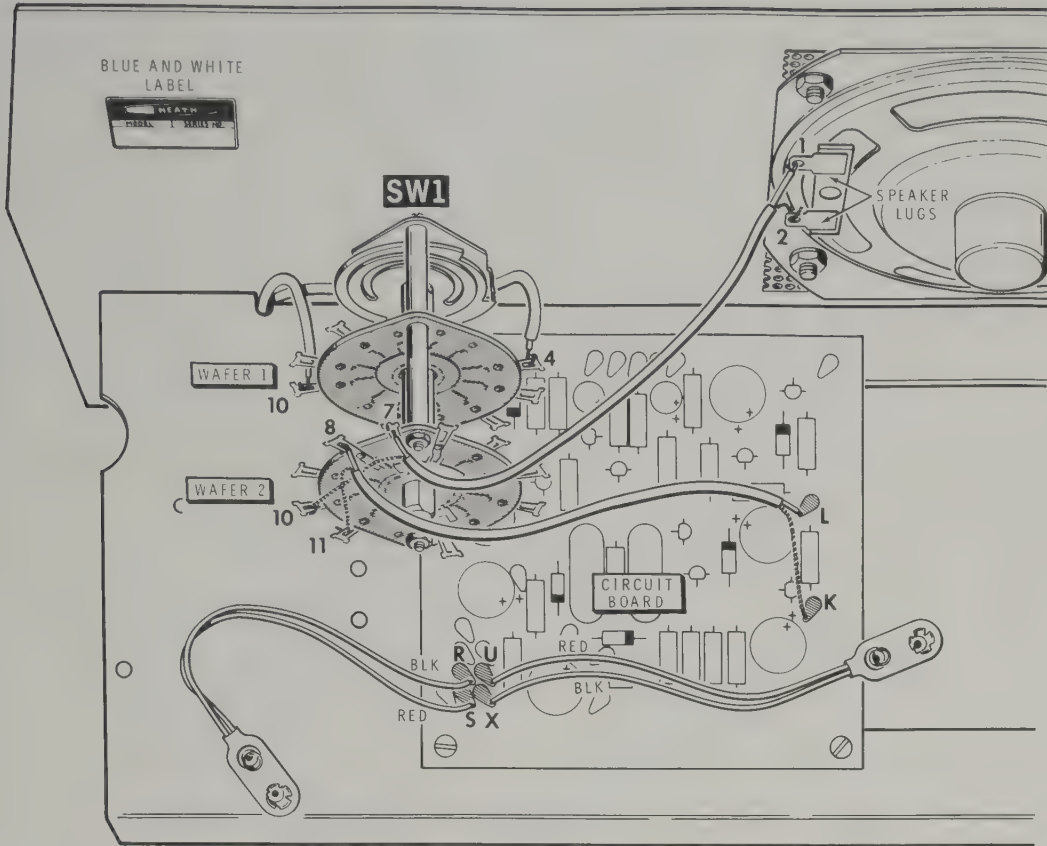
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ILLUSTRATION BOOKLET

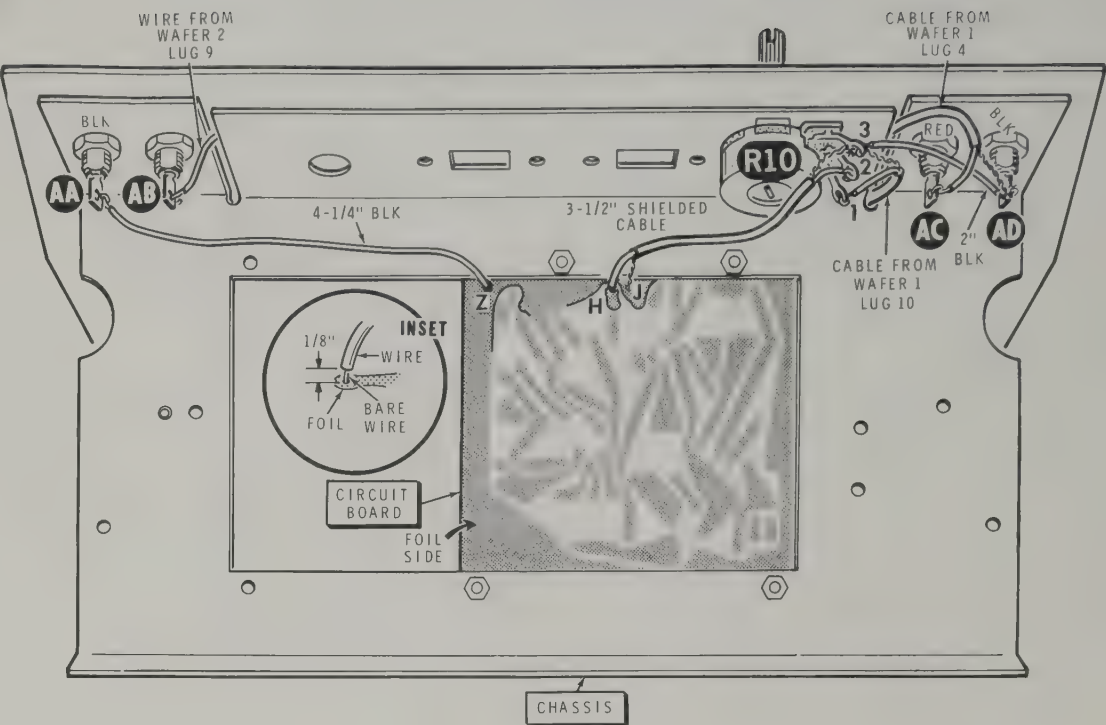
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PARTS PICTORIAL

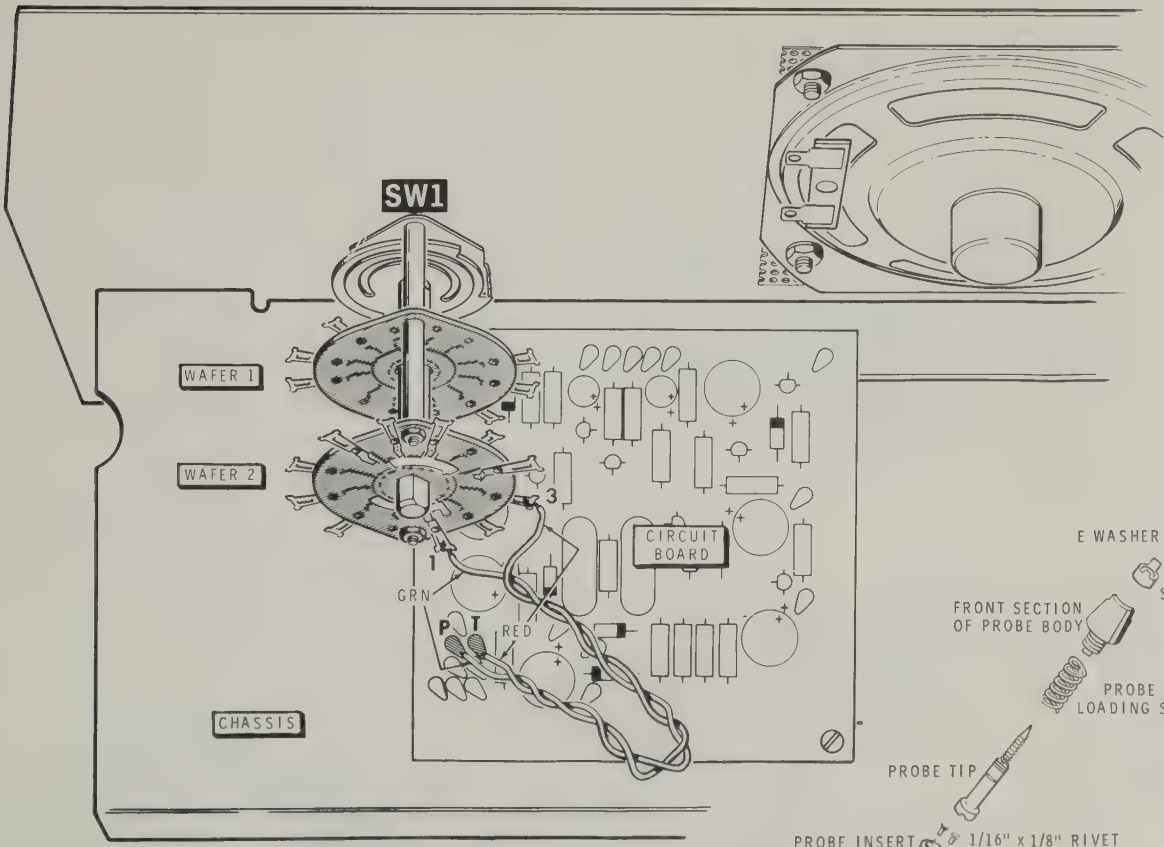




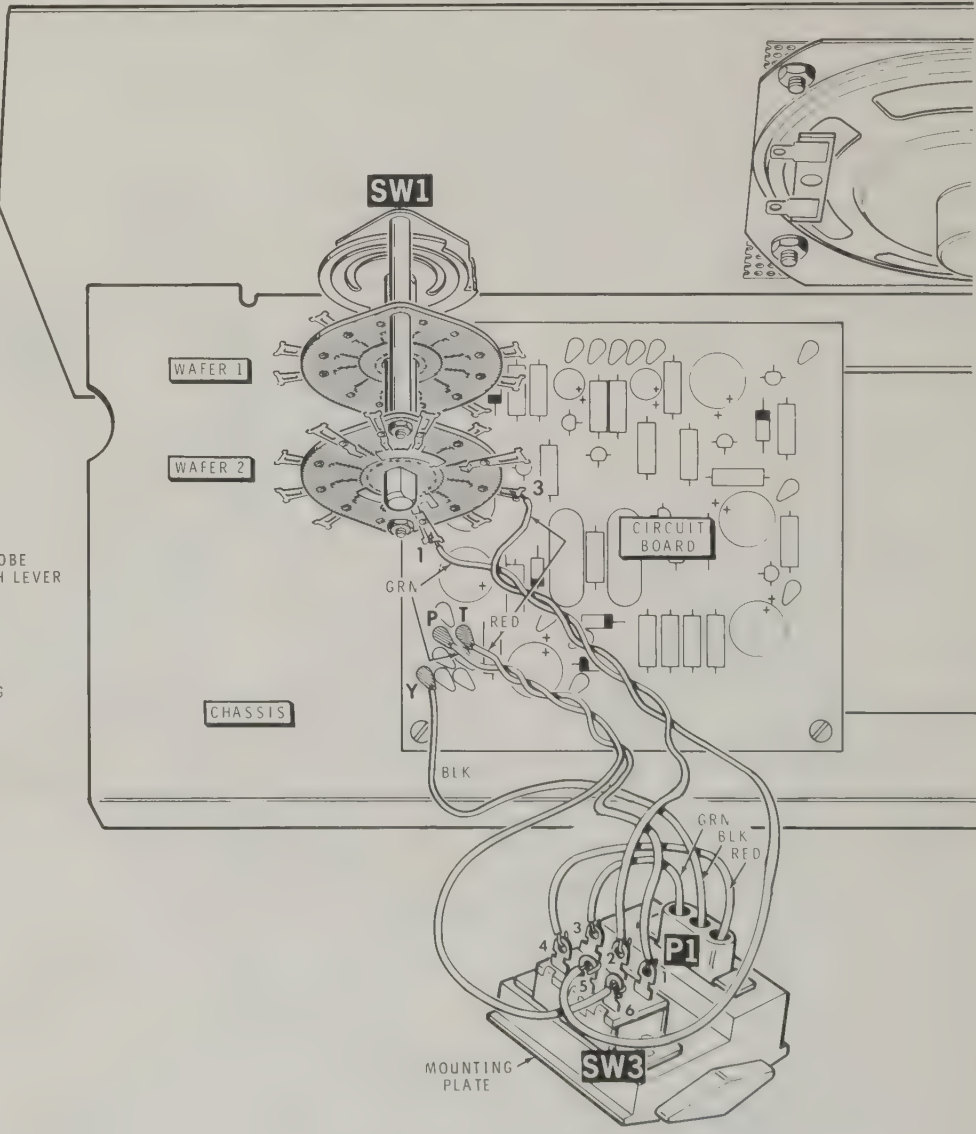
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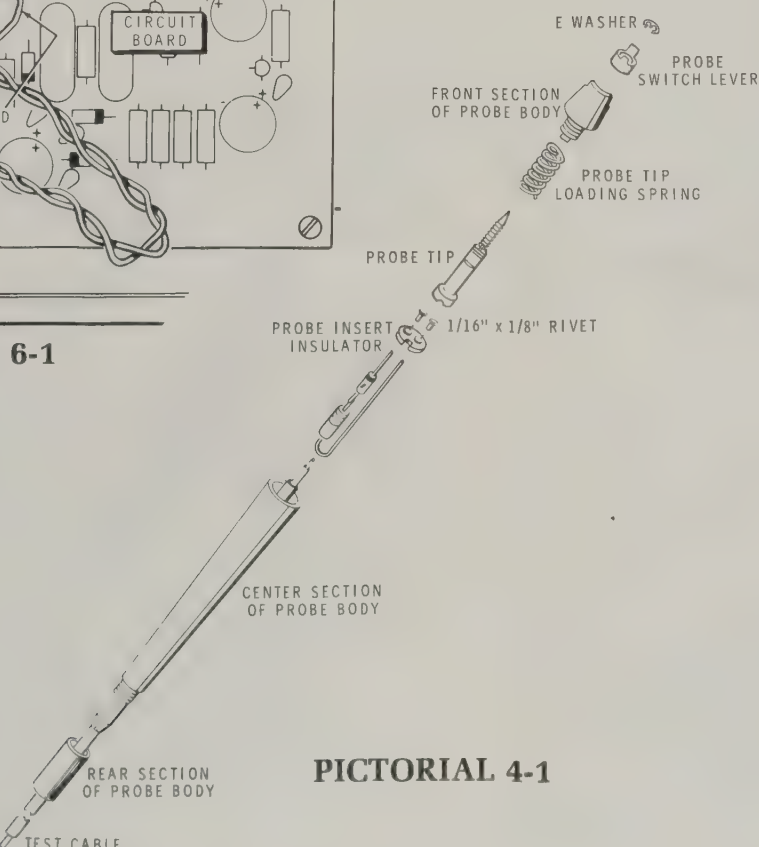
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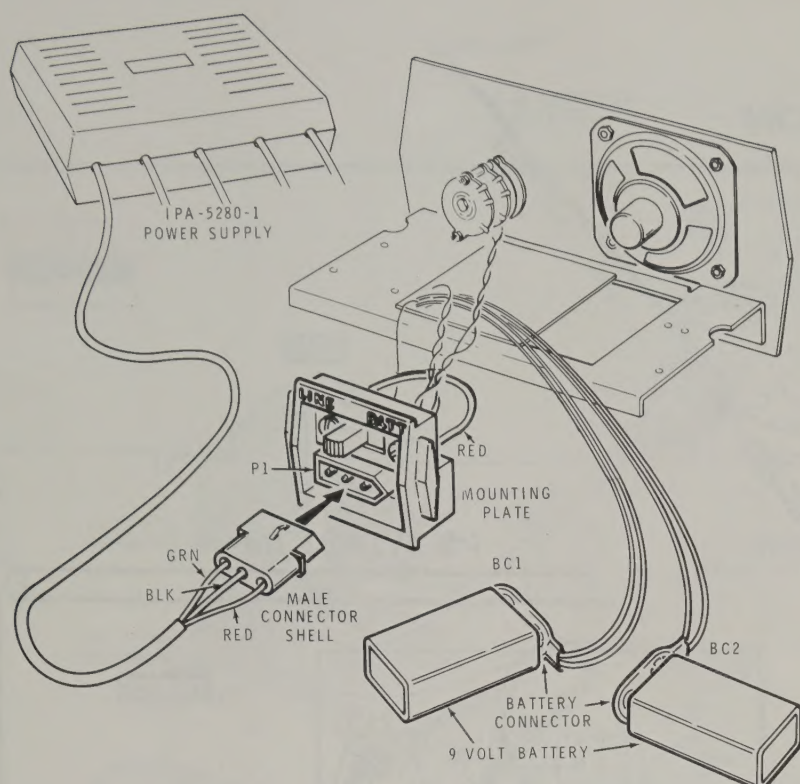
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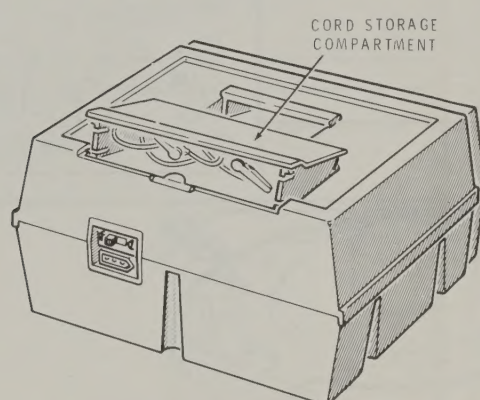
PICTORIAL 5-1



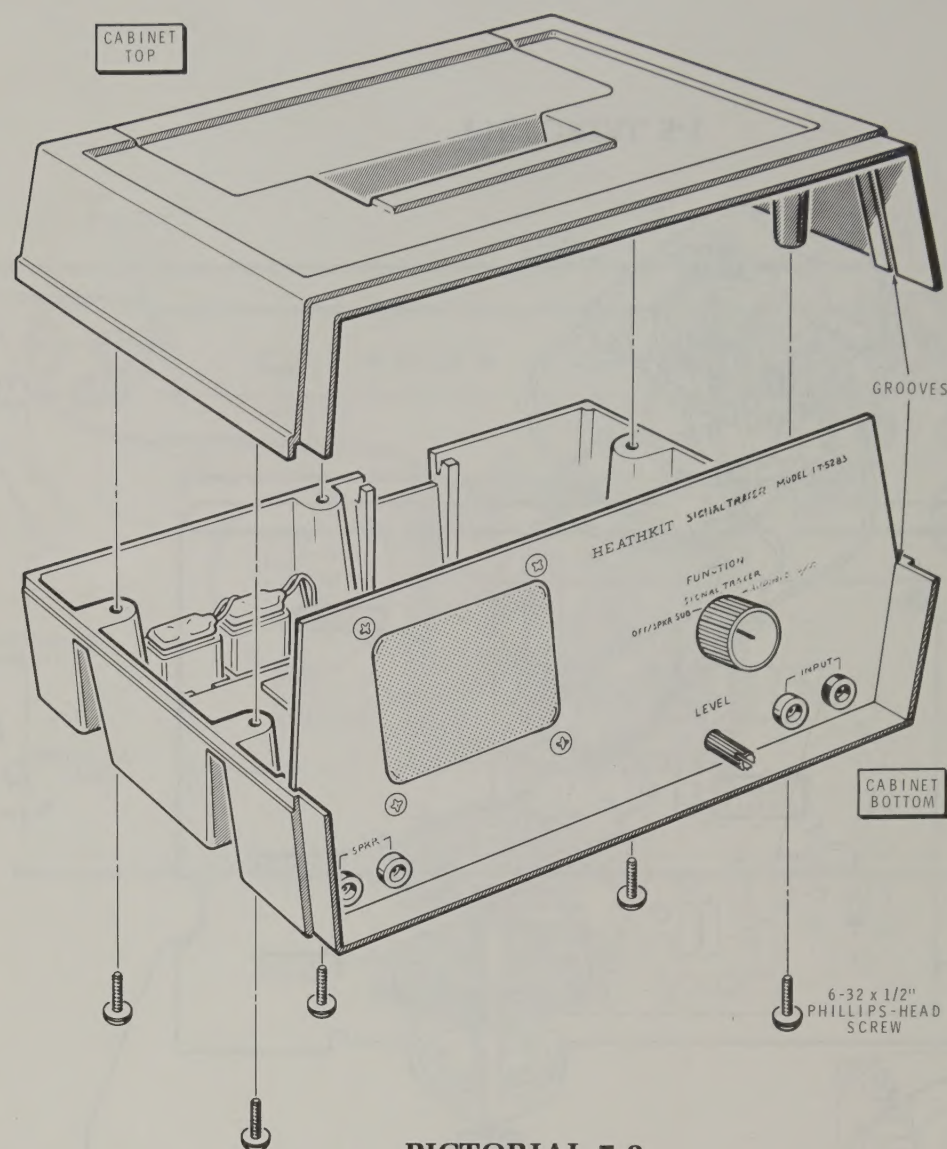
PICTORIAL 4-1



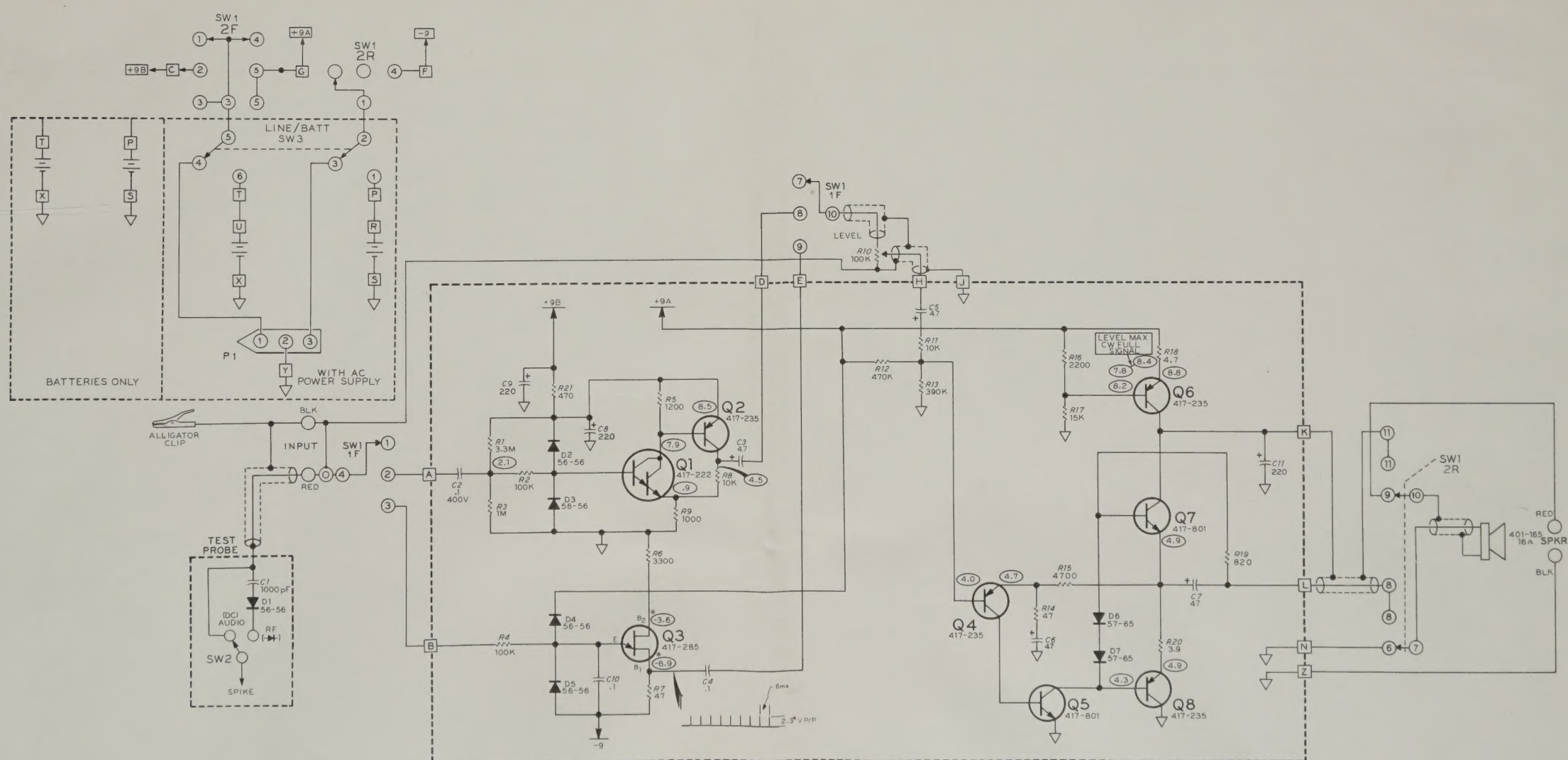
PICTORIAL 6-3



Detail 7-2C







PICTORIAL 7-2



SCHEMATIC OF THE
HEATHKIT®
MODEL IT-5283
SIGNALTRACER

NOTES:

1. ALL RESISTORS ARE 1/2 WATT. RESISTOR VALUES ARE IN OHMS (K=1000, M=1,000,000).
2. CAPACITORS ARE IN μ F.
3. SW1 IS A ROTARY SWITCH AND SW2 IS IN THE PROBE.
4.  THIS SYMBOL INDICATES A DC VOLTAGE TAKEN UNDER THE FOLLOWING CONDITIONS FROM THE POINT INDICATED TO CHASSIS GROUND WITH A HIGH IMPEDANCE VOLTMMETER:
 - A. SW1 IS IN THE SIGNAL TRACER POSITION.
 - B. LEVEL CONTROL IS FULLY COUNTERCLOCKWISE (CCW).

5.  THIS SYMBOL INDICATES A DC VOLTAGE TAKEN UNDER THE FOLLOWING CONDITIONS FROM THE POINT INDICATED TO CHASSIS GROUND WITH A HIGH IMPEDANCE VOLTMMETER:
- A. SW1 IS IN THE AUDIBLE V/Ω POSITION.
 - B. LEVEL CONTROL IS FULLY COUNTERCLOCKWISE (CCW).
 - C. INPUT IS GROUNDED.
6.  THIS SYMBOL INDICATES CIRCUIT GROUND.
7.  THIS SYMBOL INDICATES A LETTERED CIRCUIT BOARD CONNECTION.

8. ① THIS SYMBOL INDICATES A NUMBERED SWITCH LUG CONNECTION.
9. VOLTAGES MAY VARY $\pm 5\%$.
10. 1F, 1R, 2F, AND 2R ARE PART OF ROTARY SWITCH SW1.
11. WAVEFORM AT Q3 IS TAKEN WITH THE PROBE SHORTED TO THE CHASSIS AND SW1 IN AUDIBLE V/Q POSITION.

